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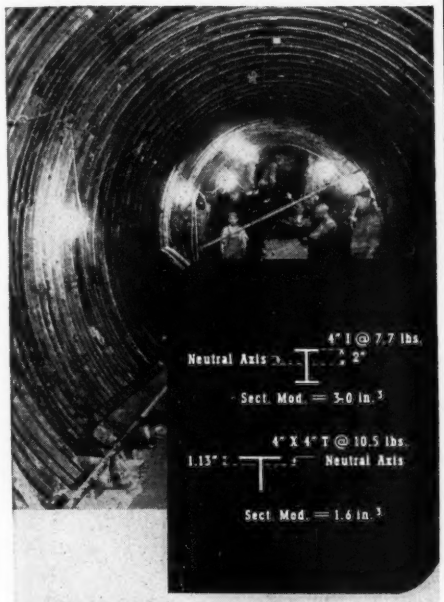

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PUBLIC WORKS

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Devoted to the interests of the engineers and technical officials of the cities, counties and states

VOL. 72. NO. 4

A. PRESCOTT FOLWELL, Editor

APRIL CONTENTS

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The Editor's Page

Highway Drainage

The articles that pass over an editor's desk should reflect the status of roadbuilding and the knowledge of the highway engineers in the field. There are few articles that do not directly or indirectly reflect the realization that drainage is one of the most important elements in road-building. An engineer from the mid-west writes of his experiences with chemically stabilized bases and their bituminous surfaces. Every local failure was traced clearly to a lack of drainage. A state highway engineer tells of his procedures in modernizing outmoded highways; his first step is drainage. And so on.

Surface and subsurface drainage are both important. Surface water if not removed promptly, contributes materially to the destruction of the roadway. Early roadbuilders found that out quickly, but it took many long years to realize the need for adequate subdrainage as well. And we might add, the lack of that knowledge and the resulting neglect of subdrainage, has cost the taxpayers many hundred million dollars.

The most heartening thing is that today city and county engineers all over the country realize the need for adequate drainage and the great majority of them know how to apply it. The longer we read, edit and enjoy the many articles that come to us, the more sure we are that the engineering of this country is, on the whole, in very good hands.

Sewage Research Saves the Army $1,000,000

High capacity trickling filters have been installed in ten or more of the Army cantonments recently completed. The actual saving to the government on these installations, as compared to the cost of the old-style standard rate trickling filters is approximately $1,000,000. This is a concrete demonstration of what the newer developments in sewage treatment are worth from a dollar viewpoint, and why every city faced with sewage disposal problems should demand that its engineer be informed on modern methods of sewage treatment.

In looking back over the developments of recent years, including high-capacity filters, full credit must be given to the manufacturers of sewage treatment apparatus. Almost every worth-while development has been made and financed by them. And this is especially true of *new* methods. Various of our larger cities have operated test plants, but mainly for the purpose of determining what *established* method of treatment was most satisfactory and economical for their own conditions. Many engineers have felt that the promiscuous patenting of processes and methods had reached a stage where "something ought to be done about it." The results obtained by the developers of high-capacity filters, which were patented and developed solely from the commercial viewpoint, should be at least a partial answer.

The million-dollar saving has an element of humor in it. Less than a year ago the Army started off bravely to reproduce the sewage treatment atrocities of 1917—the improved—or as someone called it, the depraved—septic tank, or Doten tank. High capacity filters, not to mention mechanical sludge removal and other modern and useful devices, had to be practically crammed down a good many unwilling throats. The savings that have accrued are a justification of the herculean efforts of a number of willing workers. We believe that operating results will further justify the selection of modern sewage treatment apparatus. And now that nearly all of the camps are completed, we take the occasion to congratulate the Quartermaster General and the consulting engineers he employed in doing an unusually fine all-around piece of work.

Defense Jobs For Engineers

Probably there are still some engineers looking for jobs or better jobs, and there are hundreds of jobs awaiting engineers. The Federal government is seeking to fill all sorts of engineering and technical positions, especially sanitary, airport and building design and construction, aeronautical and others.

The positions pay from $2,600 to $5,600 a year. Applications will be rated as they are received at the Commission's Washington Office until June 30, 1942. Engineers qualified in the following specialized fields are particularly needed for the National Defense Program and are urged to file their applications at once: Aeronautical, agricultural (farm machinery), construction (airports and buildings), heating and ventilating, mechanical, (industrial production and diesel design), ordnance, radio, safety, sanitary (especially public health), structural (building design), and welding.

The duties of these positions will include design, construction, and research in the various branches of engineering. To qualify for the examination, applicants must have completed a 4-year college course in engineering and have had broad and progressive engineering experience. In general, this experience should have been of a kind which required thorough knowledge of mathematics, economics, and the physical sciences. Under certain conditions additional engineering experience may be substituted for all or part of the education, and approved graduate study may be used for the experience requirement. The maximum age limit is 60 years.

The terms of this announcement, made public April 7th, differ somewhat from those of previous ones. However, persons who have been rated eligible under the examinations announced in 1940 for mechanical, aeronautical, civil, or general engineer need not file new applications. They will be placed on the list of persons eligible for appointment as the result of the new examination.

Further information and application forms may be obtained at any first- or second-class post office or from the Civil Service Commission, Washington, D. C.

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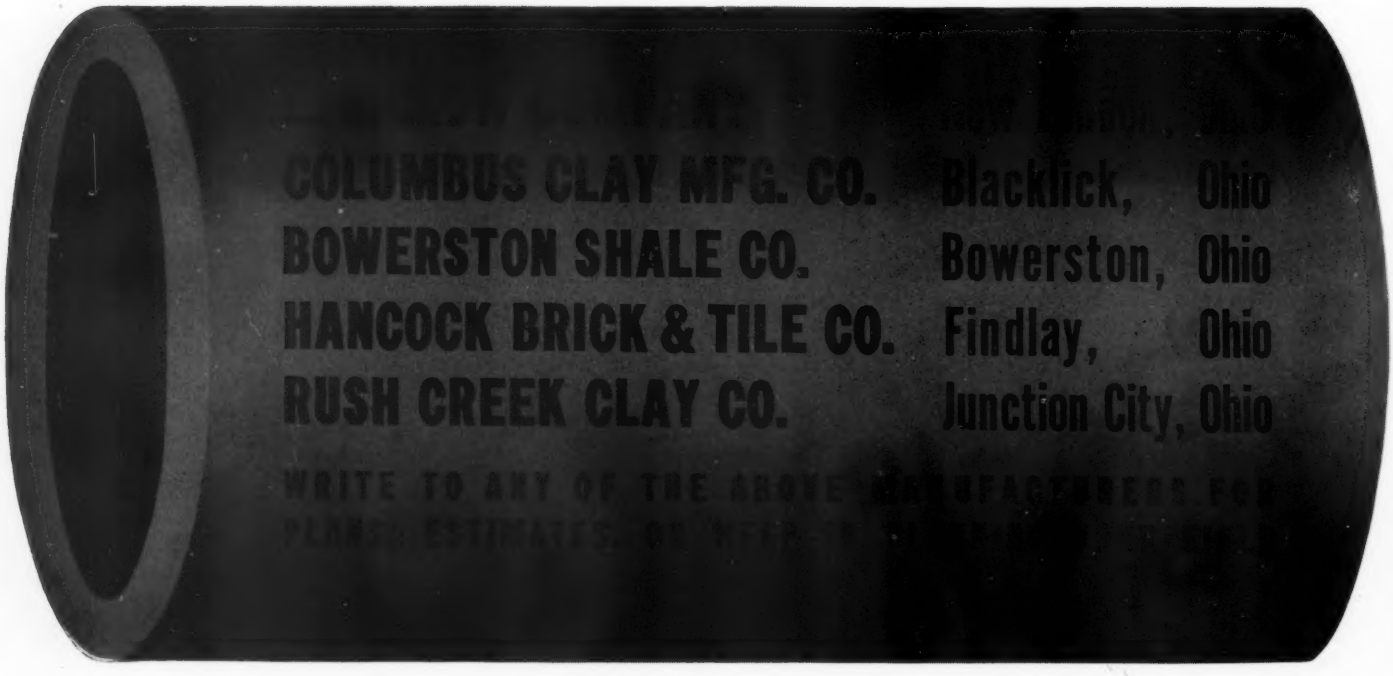

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VOL. 72. NO. 4

Locating and Stopping Water Waste in the Distribution System of Clinton, Illinois

By C. E. CORRINGTON
Commissioner of Public Property, Clinton, Illinois

C. E. Corrington

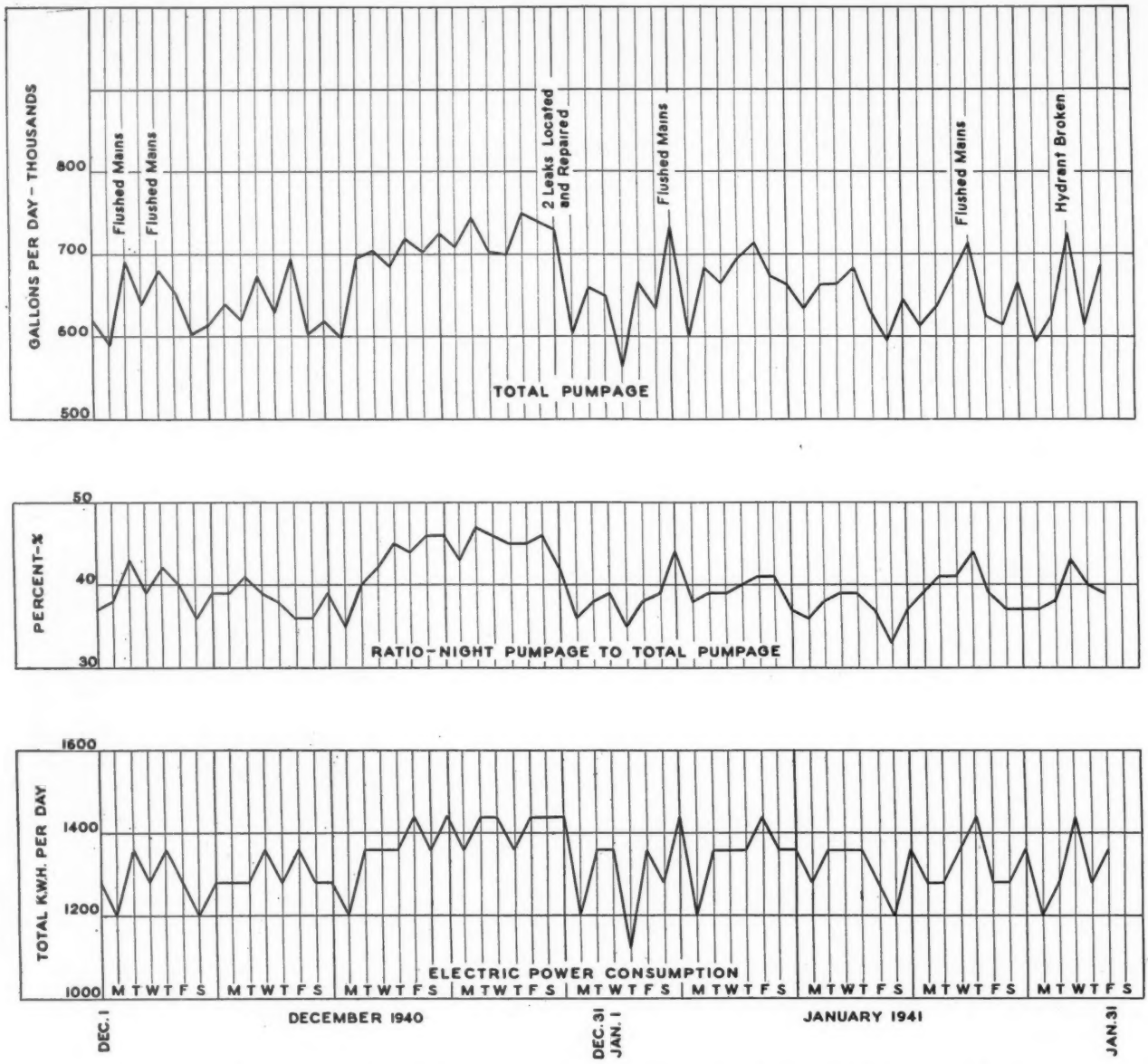
ALL water systems, large or small, have one problem in common, namely, that of "Water Wastage." Water may be wasted in two ways; first, through the under-registration or lack of meters, and second, through losses in the distribution system, due to leaks in mains, services, valves or hydrants. The purpose of this article is to deal with "Water Wastage" from the standpoint of the losses through leaks in the distribution system, with the hope that it may help others to reduce their leakage to a reasonable amount. Water lost through leakage is a double loss, since it costs money to pump it into the system, and the water thus lost cannot be sold to the consumer. While our system is comparatively small, our experiences with leaks and our methods of locating them can be applied to any system, regardless of size.

The first thing to determine in any City, is whether there are leaks of sufficient size to justify the expense necessary to locate them. Waterworks practice has determined that leaks of 3000 gallons per day per mile of main, cost more to locate and repair, than to permit to exist. Leakage in a system may be determined in two ways; the first of which is a comparison of the amount of water pumped from the plant with the amount of water metered over any period of time. If a City is 100% metered, and if all of the meters are read in the same period, this difference would give a very accurate result. However, the water used for fires, flushing mains and washing streets must be known if this method is used.

Many Cities have their systems divided into districts and only part of the meters are read at one time, in which case, the comparison would have to be taken over a considerable period of time to reach any accurate conclusions. The second method is a comparison of the night pumpage, that is, from 6 P. M. to 6 A. M., with the total amount pumped during the 24 hour period. In Cities without much industrial load, this percentage should be between 35 and 45%, but industrial Cities would have a higher percentage. In our particular case, we find that if this percentage goes over 40%, we are pumping too much water at night, which indicates some very bad leaks. We favor the second method, as a daily record of wastage can be kept, and while it will not be shown in gallons, nevertheless, the experienced operator can tell when it is too high.

There are also two methods of approaching the problem of locating the leaks in a water system. First, a reliable Waste Water Survey Company may be employed to conduct a survey of the system; or second, the survey may be conducted by the employees of the municipality or private company, as the case may be. However, unless the personnel has had experience along this line, together with the proper equipment, the results obtained will be almost negligible, except for those leaks which show on the surface of the ground. A true leak survey will locate the underground leaks that are getting away to a sewer or tile and these are the losses that must be stopped, before efficient operation can be secured.

When we felt that we were pumping too much water, we secured the services of a company who made a regular business of making Waste Water Surveys,



Two months' records of total and night pumpage and power consumption, during which leaks were repaired and mains flushed.

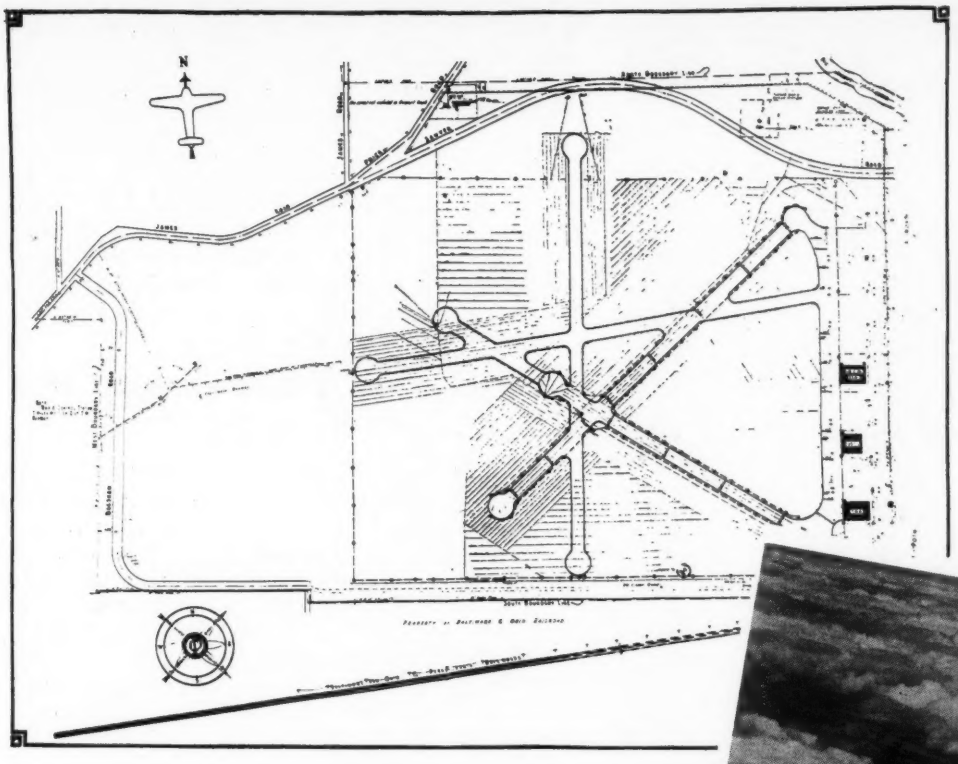
and the money spent for this survey, while it seemed high at first, proved to be one of the best investments we have ever made. They sent an engineer, a man with twenty years of experience in this work, together with the proper equipment, to conduct this survey. He spent about two weeks with us and located leaks amounting to 260,000 gallons per day, which was 40.8% of our daily pumpage at that time. In addition to locating the leaks, we were given an up-to-date map of our system, showing all mains, valves and hydrants. Working with this engineer were three of our men, and in so doing, they became much more familiar with our system.

They also acquired very valuable information regarding the use of a leak detector, and the methods used in sectionalizing the system to narrow down the territory in which a leak existed. In addition to this, they became leak conscious, as they had seen leaks located and knew that it could be done if the proper methods were used. All pumps and meters at the plant were tested for efficiency and accuracy. All meters 3" or over in size were tested and one particular case of meter tampering was found that was estimated to amount to $500.00 per year. The engineer estimated that, based on a production cost of 7 cts per 1000 gallons, the annual saving due to this survey would be $7,143.00.

Our survey was made in April, 1938, and since that time, we have been locating our own leaks, and we feel that we have been doing a very good job of it, but it requires a definite program that must be followed every day of the year. To carry out a program of this kind, it is absolutely necessary that there be available at all times, an up-to-date map of the system, showing mains and their sizes, valves and hydrants with their locations and direction of rotation and services with their shut-off valves. There should be a man in charge of the system who has most of this knowledge, especially with reference to mains and valves, in his head, as emergencies will come up, where it is not always possible to have access to the map at the moment, and his knowledge of the system may save many thousands of gallons of water. There should be a competent man at the pumping plant, who has a thorough knowledge of the pumps, equipment, meters, valves and other accessories.

The meters showing the total amount of water

(Continued on page 28)



Plan of Columbus, Ohio, airport.

Below, airplane view of airport.

Port Columbus Drainage System Serves Well

Description of system and materials, the excellence of which has been proved by ten years' experience.

WHEN the Columbus Municipal Airport was built in 1929, the theory of drainage and subdrainage was in a formative state and many factors that now are commonplace were then unknown. The excellent service results from this field make of special interest a memorandum on the design bases for drainage and subdrainage prepared by John A. Rauschkalb. This memorandum follows:

Natural Drainage.—The natural drainage slope of the site selected was generally towards the southwest the slopes ranging between 2 and 3 feet per thousand. A deep creek about 30 feet below the level of the field flowing near the northeast corner of the site was available as an outlet. A natural ravine extends from this creek into the northeast corner of the field.

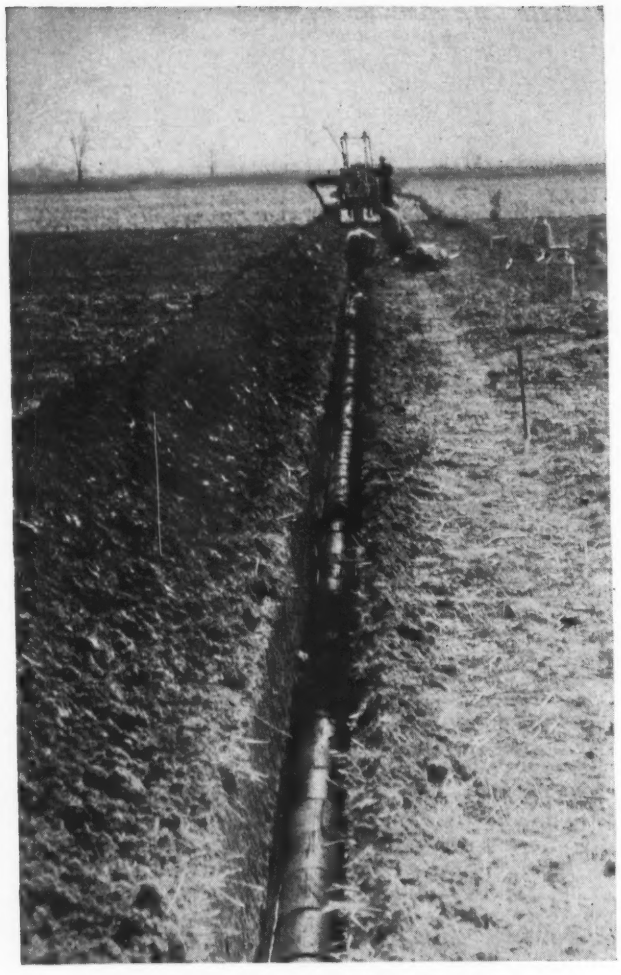
Storm Drainage. Location.—After the runways had been located, a study was made of the main drainage system. Due to the westward slope of the ground and an outlet to the east, it was not possible to reach entirely to the western boundary with the main drain, but with a maximum depth of about 16 ft. the drain could be extended well towards the western edge of the proposed present development and take drainage from an area of about 350 acres.

The drains were located along the downslope side of the runways and 50 feet therefrom, having in mind the possible widening of runways 50 feet on each side.

Design.—After much consideration, governed on one hand by the limited amount of money available and on the other by the desire to provide ample capacity, a design was selected. The size of the main line was 48″, slope .001, capacity 50 c.f.s. Assuming area tributary to this line at 350 acres, then provision is $50/350 = .15$ c.f.s. per acre. The other lines were proportioned along the runways on the basis of 1 c.f.s. per 150 lin. ft. of runway. It is thought that in this way, the runways will be quickly drained; excess water will be retained over the sodded portions of the field, should the main drains prove inadequate during excessive rains. Any such retention over the sodded portions of the field would probably exist for only a short period of time, and not present a serious problem.

Type of Material.—The type of material to be used in the construction of the 48-in. drain is reinforced concrete culvert pipe, which has about twice the steel reinforcement area used in ordinary reinforced concrete pipe. On all other sizes, A.S.T.M. Standard vitrified sewer pipe is to be used.

Sub-Drainage. Type of Soil.—In general, the soil consists of about a 12-in. layer of black soil, fairly heavy, underlaid with yellow clay. An analysis was



Excavating for and laying drain at Port Columbus.

made of the soil with reference to sub-drainage by F. H. Eno of O. S. U. Eng. Experiment Station. Nine test holes were bored in different parts of the field, each about 42″ deep. At two of the holes, there was a considerable fine shaley material in the clay and it was thought that this would drain fairly well. The other holes showed rather heavy clay which would probably drain rather slowly.

Layout.—It was decided to provide sub-drainage lines at 30-ft. intervals within the 200-ft. spaces on either side of the runways. For the area outside of these spaces, a 60-ft. spacing was selected. Under the 100-ft. runways, two longitudinal 5″ lines were proposed.

Design.—The sizes of the earth fill drains were determined on the basis of providing for ¾″ rainfall runoff in 24 hrs. or about 1 c.f.s. provision for each 30 acres. Minimum size, 5 in. Hydraulic design based on Kutter's n = .015. Gravel-fill drains are provided along each side of the runways, on one side of the taxiways, and on the main part of the field as every fourth drain or each 240 feet. All other drains are to be earth backfill except around the pipe and to a point 6 in. above top of pipe, which is to be gravel backfill. In the gravel-fill drains the top 8 in. layer is to be crushed limestone, graded 2 to 3 in. in size.

The sizes of the gravel fill drains on the down-slope side of the runways were based on providing 1 c.f.s. of capacity for each 200 lin. ft. of runway. The sizes of the gravel-fill drains on the up-slope side of the runways and those spaced at 240 ft. intervals over the field, were based on a provision of 1 c.f.s. capacity for each 15 acres of area. The sizes of gravel-fill drains along the 30 ft. taxiway were based on a provision of 1c.f.s. capacity for each 700 lin. ft. of taxiway. No drains smaller than 5 in. to be used. Minimum cover to be 2 ft.

Type of Material. — All subdrainage lines to be extra quality vitrified shale drain tile as per A. S. T. M. standard. The 8″, 10″ and 12″ sizes of gravel filled drains along the runways and taxiways are to be extra thick, extra quality drain tile, the increased thickness of wall being about ¼ in. in each case.

Sewage and Garbage Disposal at Indianapolis

The annual report of operation for 1939 of the sewage disposal and garbage reduction plants has been made available by Don E. Bloodgood, Plant Superintendent. The flow of sewage was somewhat less than during the preceding year, probably due to a considerably less rainfall, but the strength of the sewage was greater. The average flow of sewage was 51.83 mgad, of which 59.6% was treated in the primary tanks. The flow per person per day was 127.66 gallons; pounds of 5-day BOD per person amounted to 0.28. The daily average flow treated by the activated sludge method was 21.14 mg. In treating this, 1.51 cu. ft. of air per minute was used, with an aeration period averaging 8.75 hours. Plain aeration was given to 31.63 mgd. average, using 0.41 cu. ft. of air per gallon, and an aeration period of 6.72 hours.

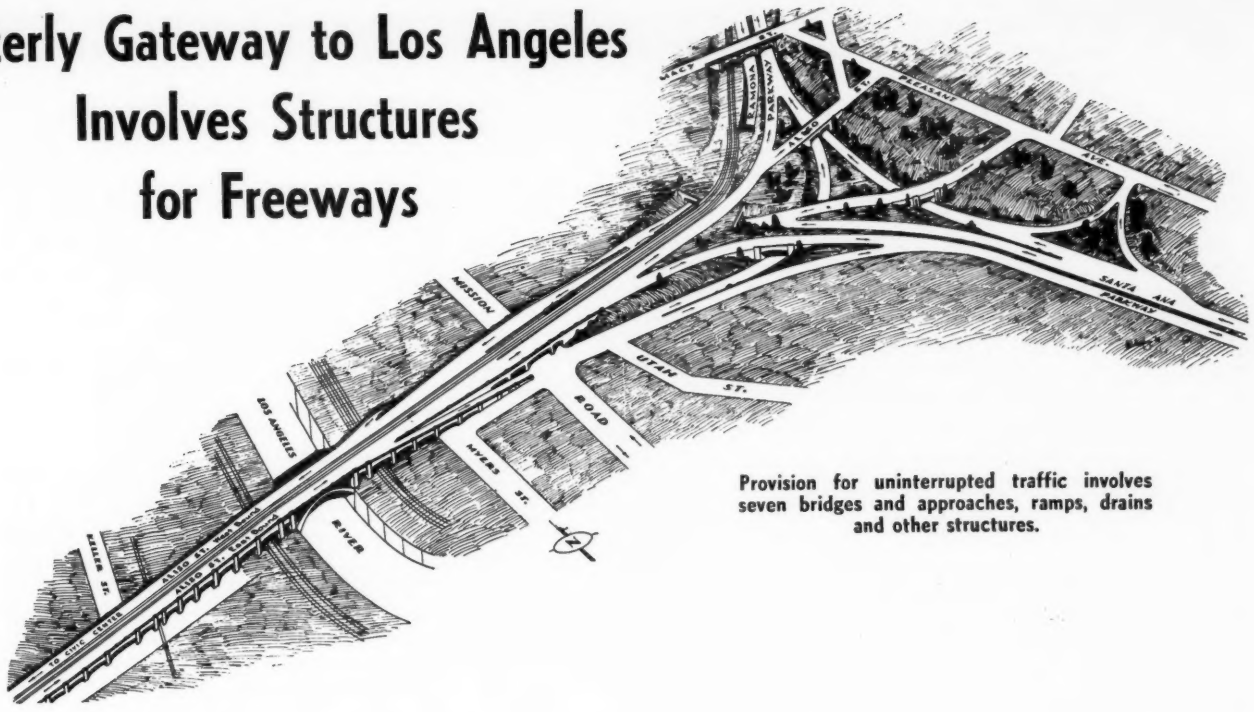
Suspended solids in the raw sewage averaged 371 ppm.; in the clarified sewage, 265 ppm.; in the activated sludge effluent, 8 ppm.; and in the total plant effluent, 35 ppm. The solids in the primary sludge averaged 5.84%; in the plain aeration sludge, 3.82%; and in the return sludge, 0.89%. The 5-day BOD of the raw sewage averaged 263 ppm.; in the clarified sewage 231 ppm; in the plain aeration effluent 87 ppm.; and in the activated sludge effluent 19 ppm. The cost of operation of the plant averaged $8.81 per million gallons, which amount was made up as follows: Grit chambers and interceptors, $0.78; clarification and pumping, $3.07; secondary treatment, $4.26; sludge disposal, $0.31; and other costs, $0.39.

In the garbage reduction plant, 29,348 tons of green garbage were handled. As a result of reduction, 832 tons of grease, 2,657 tons of fertilizer and 1,026 tons of feed were sold. The cost of operation per ton averaged $3.55, and the revenue from by-products amounted to $3.13 per ton of green garbage.

The First Metallic Concrete Truck Lane

Metallic concrete has been used extensively in floors of steel mills, machine shops and aircraft factories, where a dense, curable surface is demanded, but what is believed to be the first public use of it for road surfacing is on Kentucky highway U. S. 60 and 31-W, running through Fort Knox. Here 10,000 lineal feet of surface 11 ft. wide has been finished with red metallic concrete. As the concrete was laid, small jagged particles of specially prepared iron, furnished by the Master Builders Co., were incorporated in the surface; being troweled into the surface they become cement welded as a smooth red mat of ductile iron particles. It is said that this type of surface greatly reduces the tendency to spall and increases resistance to wear.

Easterly Gateway to Los Angeles Involves Structures for Freeways



Provision for uninterrupted traffic involves seven bridges and approaches, ramps, drains and other structures.

ONE of the most congested routes into the downtown section of Los Angeles, California feeds traffic into the Civic Center and business section over the Aliso Street bridge across the Los Angeles river, crossing at grade the main line tracks of the Santa Fe railroad on the west side of the river and those of the Union Pacific on the east side. The old Aliso Street bridge carried the double track lines of the Pacific Electric Railway Company which serve all of their lines to the east and northeast of the city, together with a single lane of highway traffic in each direction, which traffic included that of State Highway Route 26 (the Los Angeles to Pomona arterial), U. S. 60 and 70 transcontinentals through Imperial Valley, and U. S. 99 from the Mexican border to Canada, besides other traffic originating east and north of the Los Angeles area. Plans are now under way for extending Aliso Street into and across the Civic Center, which will make it one of the most important thoroughfares of the city.

The need of improved facilities for handling this traffic across the river and adjacent tracks has been evident for many years. Early plans for the project contemplated a single span across the river at a higher elevation than the original bridge, continued as a viaduct over the tracks at each end; also carrying the Pacific Electric Railway tracks above the north roadway of State Highway Route 26 on to their private right of way which is parallel to and on the north side of the highway for some distance east of this point; and carrying Mission Road under both the highway and the Pacific Electric tracks and providing ramp connections with Mission Road for automobile traffic.

Meantime plans for the ultimate construction of a freeway to Pomona utilizing portions of the alignment of Ramona Boulevard, and a freeway to Santa Ana which would have its main entrance to Los Angeles by way of the proposed structure over Aliso Street, have forced the inclusion of a rather elaborate distribution structure on the east side of the Los Angeles River as a part of the Aliso Street Project. The project is further complicated by the fact that the present route over Ramona Boulevard occupies the low land which originally drained a large area of the city, which drainage was carried in a gunite-lined ditch between the highway and the Pacific Electric; but the plan for the Pomona freeway will not leave sufficient room for this open ditch and an item of $200,000 has been included in the current biennium budget for replacing it with a reinforced concrete box.

In an effort to finance the project many conferences were held which were attended by representatives of the Los Angeles City Engineer's Office; the Union Pacific Railway; the Santa Fe Railway; the Pacific Electric Railway; the State Highway department, and various Federal agencies, all of which were involved in and would benefit by the proposed construction.

Financing under a PWA grant failed due to the rigid time limit which was placed on all PWA projects by the Federal Government, which gave insufficient time to complete the plans, award a contract and complete the construction. The need for employment in the metropolitan area to help reduce the relief rolls was acute and an arrangement was made for carrying out the project under a WPA allotment with unusually liberal terms. The Los Angeles City Engineer's office have prepared the plans and are furnishing the engineering supervision for the construction work.

When the plans, both engineering and financing, had been fully developed it was agreed to distribute the cost as follows:

Railroad funds	$550,271
County funds	291,000
Los Angeles City ¼c City Street funds	291,000
State Highway funds	491,223
WPA funds	1,981,002
Total	$3,604,496

Work was started on this project on December 14, 1939, by the construction of a shoofly to carry the Pacific Electric around the work by way of Macy Street bridge, but ground breaking for the construction work itself was celebrated on February 20, 1940, at which time actual construction work on the new project was started.

To date the Pacific Electric has built their shoofly

track around the construction; the Santa Fe and Union Pacific Railroads have lowered their tracks to a temporary location during construction work. The retaining walls for the westerly approach to the bridge have been completed and the footings and piers are nearly completed for that part of the structure. The deck to the westerly approach will be started in the very near future.

Work is now in progress on the easterly footings for the river span section of the bridge and a portion of the footing has been poured. No work is proposed to be done on the westerly river span footing until April, 1941, because of the hazard of high water during the winter months. Work is being carried on on the footing and piers for the easterly approach.

It is proposed to push the work on the distribution structure to the east. Meanwhile work is advancing on the Ramona storm drain. Connection to the river from East Mission road has already been made by means of tunneling under the maze of railroad tracks and roadways which it was necessary to cross, and the main storm drain structure is completed from the river to the Macy Street bridge.

Ramona Boulevard has been closed to traffic from St. Louis Street westerly and it is not anticipated that it will be possible to reopen it for approximately one year.

The completion of this structure will relieve much of the congestion of traffic to the east of Los Angeles and will be a notable milestone in the efforts to make it possible for traffic to flow smoothly, swiftly and safely into and out of the business district of Los Angeles.

The above is condensed from an article by A. N. George, District Construction Engineer, in California Highways and Public Works.

Restoring Water Service in Bomb-Broken Mains

When a bomb opens up a crater in a street of an English city, pavement and dirt are not the only things that fly—water and gas mains, sewers and any other underground structures are instantly and completely put out of commission. And restoring them at once to the service of the community is a superlatively important duty of the water and sewer departments. This involves not only removing shattered lengths of pipe, replacing them with sound pipe and backfilling the hole; but also, in the case of the water department, sterilizing the mains.

This sterilizing is a more important and difficult job than would at first appear. Debris has been blown by the explosion as much as 600 ft. up a water main from the crater made by a bomb. If a sewer is broken at the same time, sewage will pour into the crater and, when the water valves have been closed to isolate the break, may flow into the water mains back to such valves; and even if the sewer is not exposed in the crater, the earth tremors caused by the bomb explosion probably loosen joints in the sewer from which sewage will drain into the opening. Consequently reasonable precaution calls for the assumption that all the pipe is polluted up to the several isolating valves.

The London practice is to use bleaching powder for mains less than 12″ diameter, while for the larger ones chlorine is used, applied by means of a portable outfit consisting of a chlorinator, 6 chlorine cylinders and a gasoline engine driven pump, all mounted on a two-wheel trailer. A chlorine dose of 10 ppm is applied to all the water in the isolated section and left in contact with it for at least 15 min.; after which the chlorinated water is flushed out if practicable but this is of secondary importance. As soon as service is restored samples are tested for B. Coli, none of which has ever been found in 100 m 1. samples. In one case, when a broken 16″ main had been filled with sewage, heavily chlorinated water was allowed to stand in it for several hours, after which the B. Coli count in 100 m 1. was zero, and the 24-hr. 37° count was 2 per m 1.

Instructions for repairing mains have been issued by the British government, suggesting methods for expediting the work. Two types of joints are offered as alternatives—the mechanical, and those using plastic or liquid jointing materials. Of these the government bulletin says:

"The mechanical methods form an important group. In all of them, rubber rings are compressed in various ways to form the seal. The joints are quickly made and are not only flexible (a very important point since some settlement of newly filled ground must be expected) but so simple that operatives can learn the technique of even the most complex joints in a day or two, at most. Moreover, the joints can be made when conditions are unfavorable.

"The plastic fillings, also, have the advantage of being quick, and they require no heat. Moreover, they can be applied to a pipe which is not dry and cannot be dried, which is important. The main drawback of the technique is that a little time is required for the joint to harden, and during this period it has to be protected. On the other hand, the work can be done by bricklayers and plasterers when trained pipe-jointers are lacking.

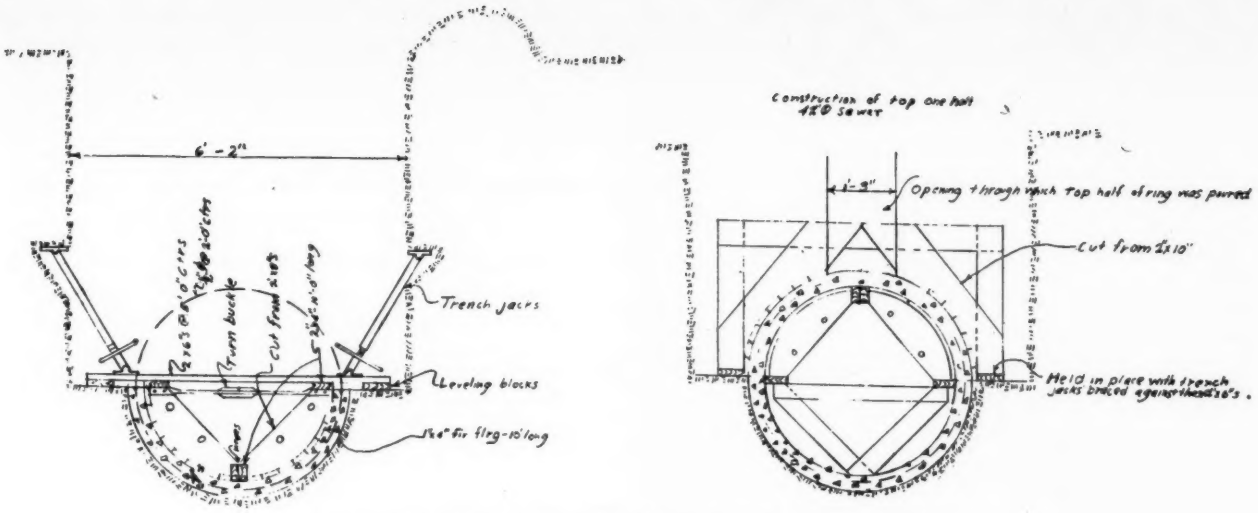
"The poured fillings in this second group of alternatives have certain disadvantages for emergency repairs which may often make them unsuitable. For instance, they have to be melted and poured into the joint cavity, which must be dry. But once the joint is run and has cooled, it comes to full strength, and the service can be restored forthwith. For this reason alone, poured fillings merit attention in emergency repair technique."

The bulletin describes in detail the practical application of these various jointing materials, and then draws the following conclusions:

"1. Full advantage should be taken of the fully mechanical systems of pipe-jointing which are considered to provide the most speedy methods for emergency repair of pipe mains. In establishing stocks of repair materials, reducers and bends will be required to suit the varying sizes of the existing mains in the systems and a limited range of sizes of mains with mechanical jonts will be required to run connections between the fractures.

"2. While it is obviously desirable that renewals should be made to full bore if possible, shortage of material or delay in its delivery, or again shortage of labor required for restoration to full bore should not be allowed to delay the work. Where a smaller size, or a limited range of smaller sizes is in stock, one of these can be used for the immediate repair, and later, as opportunity allows, the full bore can be restored. The insertion of a short length of narrower bore pipe will reduce the pressure, but usually only by quite a trifling amount.

"3. Where shortage of supplies or labor does not permit of immediate restoration by a particular method, all possible alternatives should be considered in relation to the pressure and contents of the main."



Sketches of method of constructing bottom half and top half of sewer.

Tumblebug and Sludge Monorail Help Build 42-Inch Storm Drain

By AMIEL A. REICHSTEIN
Supt. Public Works, Fairfield, Iowa

WHEN I first entered the employ of the City of Fairfield in 1928 as Superintendent of Public Works (which includes the duties of city engineer), one of my first jobs was the designing of a storm sewer system to provide adequate drainage for the seven or eight watershed areas within the city. An inadequate system had been built previously, and when the new system, which was designed by the rational system, was laid out, allowance was made for the capacity of the old system. As designed, the new system involved the construction of 400 ft. of 48-in. drain, 6,000 ft. of 42-in.; and various amounts of other sizes, from 36-in. down.

A paving program delayed the work for three years. Then CWA was started and some of the lines were built, including 800 ft. of 42-in.; none of which work presented any particular difficulty. In the intervening years more sections have been built, and all places where serious flooding occurred were eliminated, except two.

One of these areas caused damage to goods stored in a basement every time there was a heavy rain. To remedy this, the city decided to build a 42-in. circular outlet sewer required to relieve this area, using WPA. This required a run one block (346 ft.) north, a half block (155 ft.) west, and 1,500 ft. north through an alley 16½ ft. wide. In some sections, houses were so close to the alley line that there was no room to pile the dirt.

When the alley was reached, wheelbarrows were used to move the dirt into an alley running at right angles to the line of the sewer, the intention being to move it back later for backfill. A short experience showed that the WPA appropriation for labor would be exhausted before the job was half done. The city owned a T-20 International tractor and a 5-ft. tumblebug, which made a cut of the same width required for the sewer. Therefore, it and the tractor were used to excavate the ditch nearly down to the center line of the sewer; and after the sewer was built and covered by hand to a safe depth the same equipment was used to complete the backfill.

This method worked very nicely until a section was reached where business houses were very close to the alley line, at which place it was found that the area was all cinder fill. We were able to make the first four or five feet of excavation with the tractor and tumblebug, but from there on to the bottom of the ditch, due to the necessity of using sheeting, the excavation was made by hand. Some of the dirt had to be wheeled out in barrows, but a large part of it was piled along the line of the ditch. Planks were set along the building where there were any opening, such as windows or area ways, and as the dirt piled up the sheeting in the ditch was carried up to hold the dirt. The dirt was piled as high against the building as it was thought safe.

This sewer crossed three paved streets, the last of which was Burlington Street, which is Highway 34. The intention was to tunnel under this street, but after boring under it about ten feet and noticing the vibration caused in the tunnel by the heavy trucks that passed, it was decided to remove all of the dirt below the pavement, brace it, and backfill. Arrangements were made with the Highway Commission to pump mud under the slab with their mudjack after the tunnel was backfilled by hand as carefully as possible.

When there was still 132 ft. of sewer to be built, the appropriation made by the WPA had been used up, and it was necessary for the city to complete the project with city employees.

At the disposal plant which I designed (and supervised the construction of) in 1936 there is an overhead rail system for removing the sludge from the sludge beds. After the city took over the sewer construction, we removed about sixty feet of this track and set it up over the line of ditch, using it as a means of conveying the dirt from the point of excavation back to a section of the sewer that had been completed and was ready to be backfilled.

Most of this stretch was from 10 to 12 ft. deep, so we lengthened the hoisting chains so the bucket could be dropped to the bottom of the excavation. As the excavation proceeded, the dirt in excess of that required for backfilling was hauled away with a truck.

Building the Sewer

This sewer was built as a monolith in the ditch. It was constructed by making the excavation two feet wider than the outside of the sewer down to a plane horizontal through the center line of the sewer. From the center of the sewer to the outside bottom of the concrete the ditch was cut semi-circular by means of templates to provide the outside form for the bottom half of the sewer. The inside form for the bottom half of the sewer was made in ten-foot sections using 1″ x 4″ fir flooring. Two quarter-circles ten feet long were hinged together, and strap irons with a turnbuckle in them for adjustment were used to hold the forms to the required shape. Holes were drilled in the headers at each end of the form and the two abutting 10-ft. sections were bolted together to make them one continuous rigid form. Several hundred feet of sewer were built before we started bolting them together, but we found that bolting made it much easier to keep them in place. These sections were held in position by suspending them from 2″ x 6″ boards supported on the ledges formed at the horizontal center line of the sewer, where the ditch was 2 ft. wider than the outside circumference of the sewer. The semicircular forms were bolted to the bottom of these 2″ x 6″s and were kept from being pushed up out of place by the buoyancy of the wet concrete, by means of trench jacks set against the tops of the 2″ x 6″s, the other end being notched in the walls of the banks.

The concrete was poured into one side along the form and puddled until it came well up on the other side of the form. Then the bottom half was completed by placing the concrete in from the other side. After the concrete had been brought to the level of horizontal center of the sewer it was struck off and the usual construction joint was formed. After the bottom half was cured, the forms were turned over and set on A frames to make the inside forms for the top half of the sewer. The outside forms were made with an opening 18 to 20 ins. wide in the top through which to place the concrete for the top half of the sewer. These forms were so made that they rested on the ledge along the horizontal center of the sewer; they were kept from rising by trench jacks placed as already described. Special forms had to be built to make three right-angle turns. These forms were constructed in 3-ft. sections so that they could be dismantled and taken out through a 22-in. manhole.

In the last hundred feet we passed a two-stoty brick building twenty-two feet wide where the bottom of the sewer was five feet below the foundation of the building and not over two feet from it. In order to avoid opening up a very long stretch in front of this building, we precast 22 ft. of 42-in. circular sewer in 3-ft. sections and excavated only the necessary 3 feet to place the precast sections. As soon as a section was placed, concrete was poured around it and up to the level of the bottom of the foundation for the full width of the ditch to avoid any possible future settling of the foundation.

Contemplated Revision of the Treasury Drinking Water Standards

The requirements for drinking (and culinary) water provided by common carriers for the use of passengers carried in interstate traffic, commonly known as the "Treasury Department Drinking Water Standards," were last revised in 1925, and published in the Public Health Reports of April 10th of that year. Since that time many improvements in water supply practice have been adopted with resulting increased uniformity of quality and safety to the consumer. The revision of the standards to conform more closely to current requirements for water supplies of attainable safety and potability is accordingly in order.

To carry out such a revision, the Surgeon General has appointed a special advisory committee composed of representatives of ten Federal organizations and scientific associations and four members at large. A smaller sub-committee of five Public Health Service officers has been designated to prepare tentative suggestions for changes in the present standards which will be submitted for the consideration of the advisory committee. J. K. Hoskins, Chief, Sanitation Section, Domestic Quarantine Division, is secretary of both the advisory committee and the sub-committee.

Costs of Refuse Incineration in Toronto

Combustible refuse is burned in four incinerators in Toronto, Ontario, Canada. The Don destructor was first placed in operation in 1917, and was remodeled in 1932. It consists of 3 furnaces and has a rated capacity of 300 tons per 24 hours. In 1939, 38,222 tons of refuse were destroyed at a total cost of $1.65 per ton, of which the labor was $1.56 per ton. Cost per ton in 1938 was $1.63 and in 1937 it was $1.66.

The Wellington destructor was completed in 1925. It has four furnaces and a rated capacity of 400 tons per 24 hours. In 1939, 49,844 tons were destroyed at a cost of $1.42 per ton, of which the labor cost was $1.32 per ton. Approximately the same amounts were burned in 1938, at a cost of $1.38 per ton, and in 1937, at a cost of $1.49 per ton.

The Symes Road destructor was completed in 1934; it is a crane-operated plant of four furnaces with a rated capacity of 500 tons per day. In 1939, 62,029 tons were burned, as compared to 60,309 in 1938 and 56,734 tons in 1937. The 1939 costs per ton were $0.95, of which $0.82 represented labor; total costs per ton in 1938 were $0.85, and in 1937 $0.94.

The Island incinerator is used only during the summer. It is a small plant with one furnace and a capacity of 25 tons per day. In 1939, 1,123 tons were destroyed; in 1938, 952 tons, and in 1937 1,100 tons. Total costs per ton in 1939 were $1.23, of which $0.72 was for labor. Total cost per ton in 1938 was $1.09 and in 1937, $0.94.

In 1939, 151,219 tons were incinerated at a cost per ton of $1.28, of which labor costs represented $1.17. In the five years preceding, the costs per ton did not vary more than 5 cents from this figure.

Meat Packing and Slaughter House Wastes in Texas

Tremendous numbers of animals slaughtered necessitate use of great quantities of water, and disposal of very strong sewage resulting therefrom.

THE following notes and tables have been abstracted from a 70-page report "Meatpacking and Slaughter House Wastes," issued by the Texas State Department of Health. The report criticises the tendency of the meatpacking plants and abattoirs to install small vats and septic tanks in the belief that these are accomplishing a worthwhile purpose in treatment, as it is indicated that these units are more detrimental than they are helpful.

The stockyards in Texas are showing tremendous receipts of animals by trucks, and this introduces a problem in that the accumulated wastes and manure from truck floors must be disposed of before the vehicle leaves the yards. This accumulation has been found to have a 5-Day Biochemical Oxygen Demand as high as 800 or 900 parts per million and the waste represents a considerable problem both as to strength and quantity.

One of the chief features of the report deals with water usage. Fourteen tables show the variations in water usage at various plants. It has been found that water usage depends primarily upon the availability of the water supply, that is, whether or not the supply is owned by the industry or is furnished by a municipality. The type of operations carried on in the plant, as well as individual arrangements within the plant itself are further important factors in determining the water usage.

Water Usage per Animal Slaughtered

Company	Daily Animals Kill	Equiv. Hog Kill	Gallons of Water Used	Gallons of Water Used Per Animal Kill	Gallons of Water Used Per Equiv. Hog Kill
C	165	400	85,000	185	75
G	700	1830	320,000	475	177
E	380	632	54,000	222	85
E	452	640	193,000	246	171
			Average	282	127

An average of all abattoir and meatpacking plant usage shows 220 gallons of water used per animal slaughtered, but there are many variations. A plant purchasing its water supply averaged 75 gallons per equivalent hog handled, whereas a plant which had its water supply delivered under artesian pressure without cost had a usage of 635 gallons per equivalent hog. The operations carried on in the plant itself were important factors in determining the water usage. The water used per animal during the killing operation at a representative plant was found to be 183 gallons, whereas 449 gallons were used per animal over the entire operation day, which included the processing of the tankage, preparation of bone meal, sausage, and ham curing.

Some tables show the variations in strength of wastes from the various operations. A typical result is shown in the following table.

Strength of Waste by Operations

Source of Waste	Quantity g.p.d.	Total Solids	p. p. m. B.O.D.	p. p. m. Oxygen Cons.	p. p. m. Chlorides	p. p. m. Alkalinity
Rendering Tank	4,000	40,500	18,500	7,600	1,430	1,360
Paunch wash	100,000	3,460	900	820	132	725
Gut hasher	10,000	50,200	5,400	6,500	225	—
Killing flow, etc	240,000	4,000	1,680	740	405	760
Boiler water	220,000	2,800	210	125	940	300

In this table the term "boiler water" is a misnomer, because it contains washings from the hog pen as well as waste boiler water.

The methods of sampling packing house wastes because of these variations in strengths in the different departments was one of the difficult parts of the survey. Proper proportioning and weighting of the operations and the flows from each department was perhaps the most critical part of the entire work since an error in evaluation of the flow or importance of any particular process could have made a large difference in the results.

One of the most interesting and important features of the report deals with the population equivalents contributed by the packing companies to the city sewers or to the receiving streams. In one particular town under investigation it was found that the packing plants contributed a sewage load equivalent to the wastes from a municipality of 55,000 people; while another town contributed wastes equivalent to 50,000 people. These loadings on the city sewers necessarily represent a tremendous unexpected sewage addition which must be handled by the sewage treatment plant. The report assumes that these total population equivalent loadings would be considered in setting rates for sewer service.

Water Usage and Population Equivalents

Date 1940	Company	Gallons Water per Animal Kill	Gallons Water per Animal Oper.	Population Equivalent Kill	Population Equivalent Oper.	
5-23	G	203	519	10	24	Hogs
		614	1553	35	89	Cattle
6-4	G	242	432	20	35	Hogs
		598	1070	37	66	Cattle
7-26	G	287	489	28	47	Hogs
		749	1270	50	85	Cattle
	Average			20	35	Hogs
				40	80	Cattle

Other tables in the report show population equivalents of various types of plants and the population equivalents involved in slaughtering and processing of various types of animals. As shown in the table above, during the hog killing operations the slaughter of each hog represented in contributed wastes on the B.O.D. basis a population equivalent of 20, whereas the complete processing of the hog and pork products

represented a population equivalent of 35. For cattle the population equivalent during the slaughtering period was 40 and during the entire operation day it was 80. Naturally the size of the plant and the efficiency and rate of its operation, and especially the usage made of the by-products, affect these figures.

The report states that the meatpacking waste problem in Texas is increasing, and that either pre-treatment at the plants is essential or a definite enlargement of municipal sewage treatment plants is necessary to handle this hitherto uncalculated sewage load. It further suggests that the meatpacking industry in cooperation with the cities should attempt a review of the financial responsibilities involved in the treatment of meatpacking plant wastes.

It is stated that the chief purpose of this investigation was to have at hand accurate Texas data which would indicate to municipalities or to meatpacking plants the quantity of water that would be necessary to be provided for the scheduled operations in that plant. It was furthermore intended that this survey would indicate the loading on the sewer system that would be involved by such scheduled operations, and for this reason special attention has been given to the problems of flow loads and waste strengths.

The Bulldozer's Mate

A few days ago we received photographs of work being done on the the Shasta Dam project by Pacific Constructors, Inc., one showing a Caterpillar Diesel tractor with a Le Tourneau bulldozer; another showing a similar tractor with a "cowdozer." Now a cowdozer was a new one to us and we asked for more information. Perhaps some of our readers may be equally ignorant, so we pass along the information received from Jack How, of Caterpillar Tractor Co.

Says he: "The cowdozer is somewhat akin to a rotary scraper—that is, it is used for approximately the same type of work. On a level haul, or where digging is required, it isn't much of a tool to have around. On a downhill push with a bulldozer, however, it can add 3 or 4 yards to the dirt-moving capacity of a tractor. The cowdozer is most often used where there is soft, loose dirt that can be easily handled.

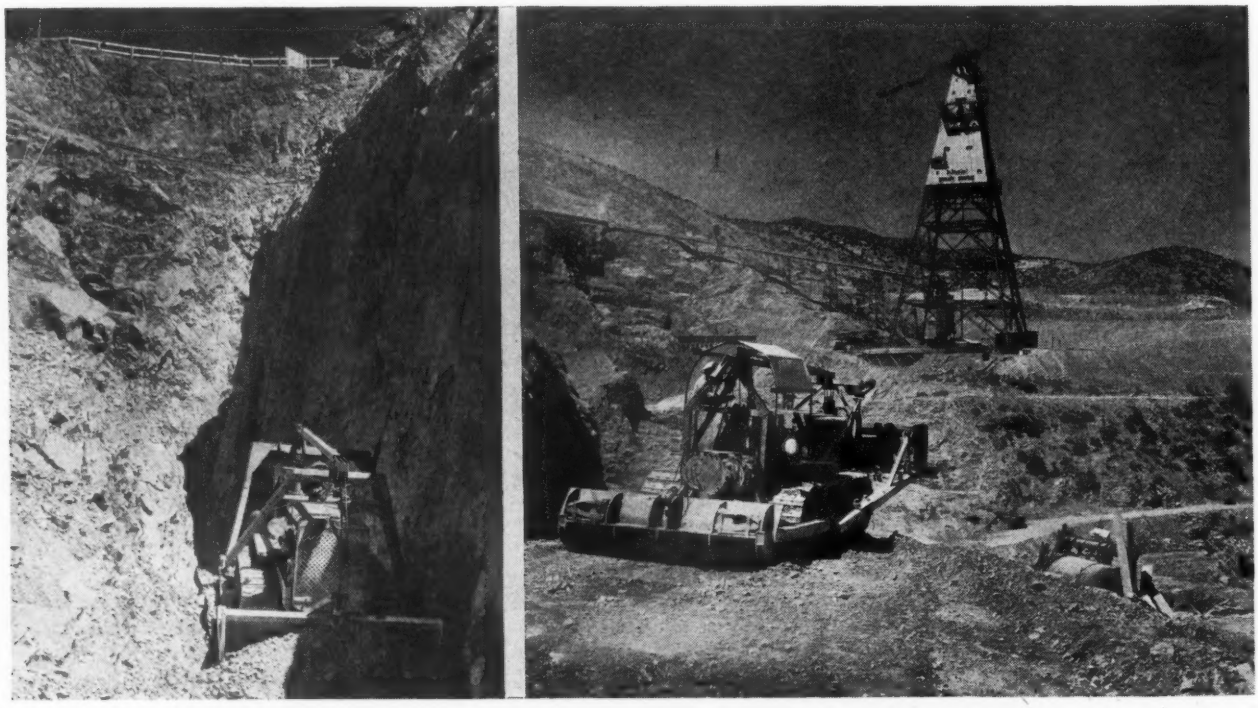
"It has another convenience. There are considerably less working parts on this kind of a machine than there are on a rotary scraper. Also, the cowdozer can use a double drum cable control unit in common with the bulldozer.

"So far, we've no record of calf-dozers. But we'll keep you posted." (This last was in reply to a request that Pacific Construction Co. send us photographs of the little calf dozers if there should be any running around next Spring.)

Gary News Dealers Keep Their Corners Clean

The two main streets of Gary, Indiana, are continuations of State highways. The State Highway Department is legally responsible not only for maintaining these streets but also for keeping them clean. The city of course is responsible for cleaning the intersecting streets and therefore both State and City are responsible for cleaning the corners at intersections.

This situation might lead to disputes concerning responsibility for unclean corners, but has been solved neatly by putting the responsibility on a third party. A number of these corners are occupied by news stands, and the operators of these (presumably in return for their city licenses) keep their respective corners, including the corner gutter area, clean of all refuse. The State Highway Department furnishes each news stand with a shovel and push broom. Refuse picked up by the news stand operators is placed in a nearby litter container and collected by city forces. Credit for developing this plan is given to C. E. Johnson, Street Commissioner of Gary.



At the left is a bulldozer. At the right his mate, the cowdozer. Both working on Shasta Dam.

How Soil Stabilization Provides Improved Subgrades in New York State

By H. F. BRUMM,
District Engineer, N. Y. State Division of Highways

DISTRICT No. 6 of the New York State Dept. of Public Works, Division of Highways, embraces six adjacent counties, four of them along the northern boundary of the State of Pennsylvania and two adjoining the Finger Lakes. From east to west the district is 160 miles in length and it averages 50 miles in width.

Average annual precipitation approximates 35 inches with 40 inches of snow. Normal frost free periods on the south boundary are about 120 days while at the northerly side of the district along the lakes, the period is 160 days. Freezing of soils may be anticipated to not less than three and generally not over four feet in depth. Annual temperature ranges are as much as 140° F. from 35 below to 105 above zero.

During the past four-year period we have been directing our efforts toward the definite improvement of our highway subgrades, embankments and backfills. Our endeavors have been to eliminate soils associated with highway failures and, at the same time, develop a standard practice based on experience that will be generally applicable to future construction projects.

The breaking up of pavements much short of their life expectancy, the sloughing of fill slopes and the uneven settlement and lateral movement of fill material, with resulting interruptions of traffic flow and large maintenance expenditures all indicated the necessity of improved construction methods, particularly in connection with subgrades.

Extra compaction methods with some moisture control were first specified in District No. 6 in contracts let in the Spring of 1937. The experiment established the advisability of additional requirements and more exact laboratory analysis and field control.

During that year we were to undertake the reconstruction of 9.3 miles of Route 17 in the eastern part of the district between the cities of Elmira and Binghamton, on which existing conditions indicated a general lack of stability. The original highway was built in 1913 and 1914 of a light macadam type and involved less than 7,000 cubic yards of excavation per mile. A concrete pavement 6″ and 7″ in thickness was placed to approximately the same line and grade as the macadam between 1920 and 1933. For a five year period, however, the pavement had been breaking badly, with disintegration progressing rapidly.

Maintenance costs had been very high and the resident engineer in charge of the section reported that during the periods following spring thaws the pavement, when subjected to heavy traffic would weave and undulate as though supported on sponge rubber and that in some places slabs tilted to such an extent that vehicles were unable to pass and trucks frequently broke through into the underlying semi-liquid soil. These characteristic failures led to the conclusion that the behavior of the subgrade was responsible for the pavement breaks. The embankment soils used in the original construction were without doubt the upper crust of sidecut silts obtained in light excavation.

More complete application of the principles of soil mechanics and stabilization were determined upon and incorporated in a contract let in September 1937 for its reconstruction with concrete pavement. The 1937 contract required over 47,000 cubic yards of excavation per mile and new location on virgin soils was used for about 80% of the project. The soils in the area traversed were gravel, silt and dense clay with some stone.

Gravel was distributed along about eight miles and was situated below a silt layer varying in depth from 2 to 6 feet. In one stretch of 1,500 feet a silt layer of 20 feet in depth was encountered containing thin layers of clay with surfaces of thinner layers of water bearing sand. Fortunately too, gravel of good quality was available in borrow pits, making for ease in blending in conformity with the specification prepared in this first extended effort. A tough clay soil with elastic characteristics with no other type than a thin layer of top toil was found on about $1\frac{1}{3}$ miles.

Sampling and classification was accomplished jointly by the Laboratories of the State and Federal Bureau and were taken generally from cut slopes or shallow test pits. In construction it was found that in some cases the samples, especially in the mile and a third of clay, did not represent the major fraction to be excavated. Generally the soils were classed in the A-2 and A-4 groups. Provision was made in the specification for blending the two types by spreading in layers of predetermined thickness and mixing, the combined layer not to exceed 8″ in thickness and having not over 75% of A-4 soil nor more than 40% of the total mass passing a 200 sieve. Moisture control and compaction to Proctor densities were required. Compaction was by tamping rollers capable of producing 230 lbs. per square inch, on any row of teeth. Moisture contents to within 1% of the optimum were to be established either by the addition of water or by intermixing of drier material.

In 6 original samples classed as A-2, the liquid limits ranged from 21 to 28 with an average of 23. The plastic index ranged from 0 to 7 with an average of 4. In 10 classed as A-4, the liquid limits ranged from 19 to 27 and an average of 22. The plastic index ranged from 0 to 6, averaging 4. The cohesive clay liquid limit ranged from 28 to 34, averaging 32. Its P.I. ranged from 22 to 25. The A-2 soils were blended with either A-4 or stony clay, but we were unable to blend successfully the three types together due to our inability to break up the clay satisfactorily.

The work, involving 444,000 cubic yards of excavation, was accomplished by power shovels and rubber tired 12-yard carryall scrapers and 10-yard bottom dump carts.

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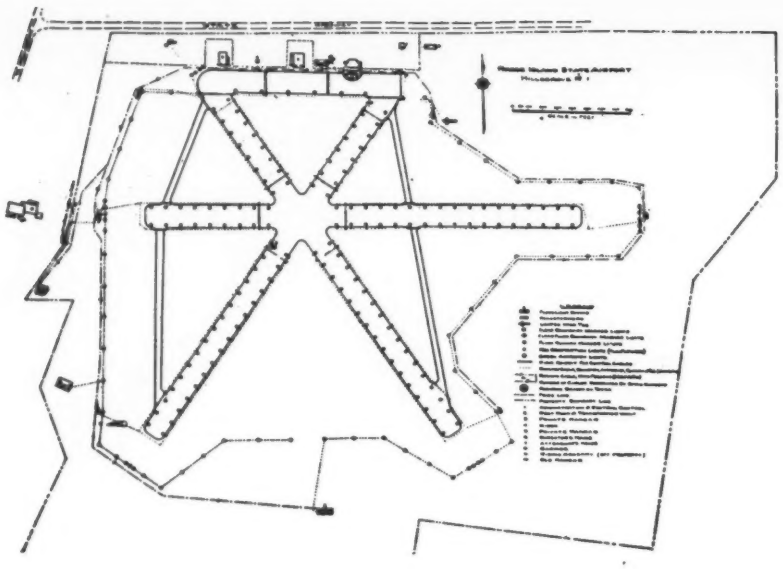


Dimensional diagram of layout and lighting system of R. I. State Airport.

Water Supply, Rhode Island

By DAVID D. BOUCHARD

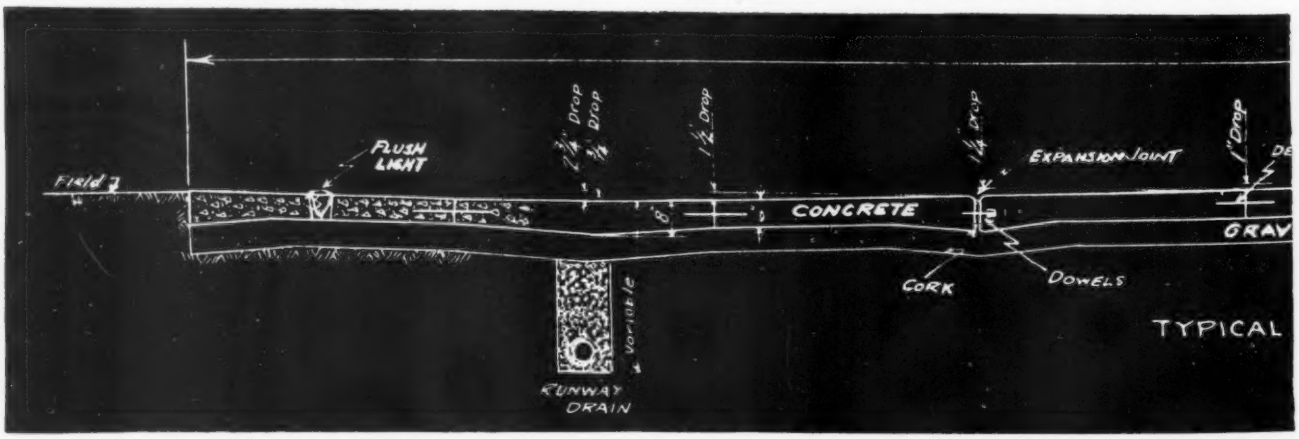
LOCATED in Warwick, six-and-a-half miles outside the City of Providence, the Rhode Island State Airport, with broad concrete runways equal in area to 30 miles of single-lane highway, is fortunate in being able to obtain its water supply from the larger city. For several years Warwick has purchased its water wholesale from Providence, redistributing it through its own pipes. The importance to the airport the availability of this abundant supply cannot be over-estimated because of the phenomenal growth of activities at the landing field during the last five years. So rapid has been the port's commercial development, to say nothing of the urgent demands by the various military units in recent months, that the problem of water has become of vital importance, especially from the standpoint of adequate fire protection for the many buildings and planes. With hundreds of student pilots in training, and with the number of private planes increasing steadily, the need of greater facilities is already apparent, and steps are underway to provide for the future by augmenting the present 6″ water main with a 16″ one.

The development of the Rhode Island field presents ample evidence of the need at the outset of providing generously for the future in all phases of airport construction, including drainage, water, lighting, sewerage, concrete runways, hangars, etc. When first opened in 1931 (but before proper drainage had been installed and runways built) few planes landed and there were no scheduled operations. An airport manager and a maintenance man were more than sufficient for all needs. Without lights, night-time put a halt to flying, winter saw the field practically snowbound, and rainy weather turned the port into an oozing marsh.

Conditions are entirely different now. The latest published report of Willard M. Fletcher, Chief, Division of State Airports, covering activities for 1939, shows 34,000 landings, 34,000 take-offs, 429 students trained (fixed base), 19,551 passengers carried (fixed base), 5,465 passengers inbound (scheduled), 5,138 passengers outbound (scheduled), 49 private planes based at the port, and 1,564 planes registered as visiting for varying periods; and 37,033 pounds of mail and 36,264 pounds of express matter was handled. Since this report, military activities at the field have greatly increased, as have commercal and private operations. Facilities also have had to be provided for the thousands of spectators who visit the field annually. Sundays and holidays bring out throngs, and hundreds visit the field on pleasant summer evenings. For the public's accommodation there are now two large waiting and comfort rooms.

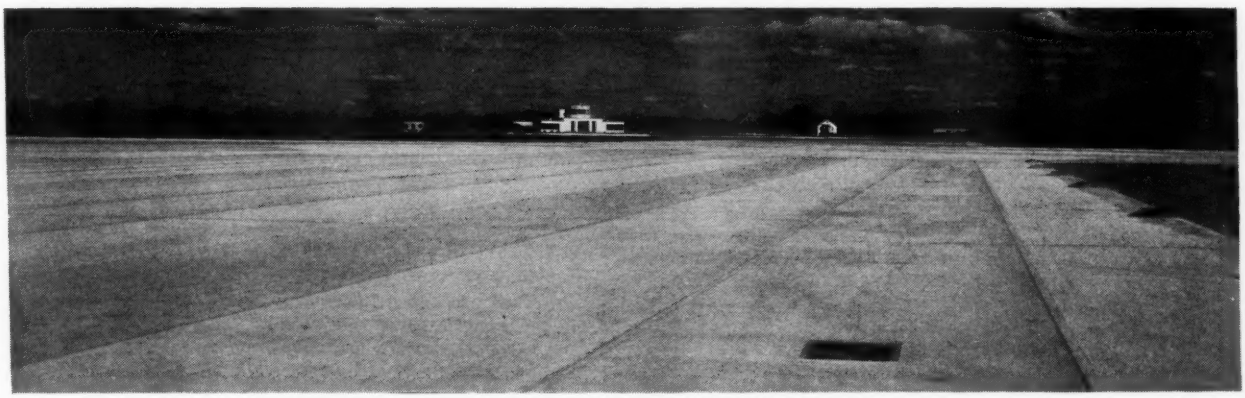
The 6″ water main provides for normal usage, i.e., running water and lavatories in the administration building, the American Airlines terminal building, the hangars, quarters leased to private aviation concerns and individuals, the signal tower and dwellings of the airport manager and maintenance crew, besides a State Police barracks which is also located on the property. The 16″ main is primarily for fire hydrants, two inside the large hangar and four outside near the buildings, and for additional hydrants and a sprinkler system which are to be installed. It is so connected it can be used in emergency for normal purposes in the event of failure of the smaller regular supply line.

The problem of sewage and waste disposal was not



Sewerage and Drainage at State Airport

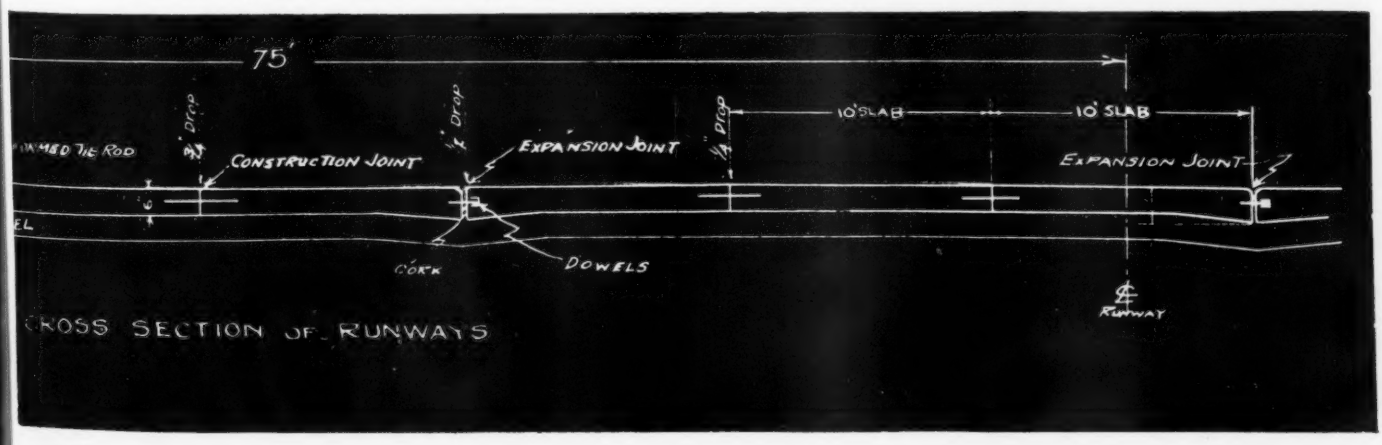
Water obtained from Providence; temporary disposal of sewage in cesspools; area drained by more than six miles of drain pipe.



Concrete runway with catch basin in foreground, Rhode Island State Airport.

so easily or permanently solved. Warwick has no sewer system of its own, and plans for a metropolitan system to handle the sewage of virtually all of the outlying suburban communities, including Warwick, failed to meet popular approval and so has been shelved, for the time being at least. The airport at present discharges its sewage into seven cesspools. As these are in a good gravelly sub-soil they have met all demands so far made upon them, but whether they will continue to do so remains a question for serious cogitation. The cesspools are located adjacent to the buildings they serve, four large ones for the bigger buildings and smaller ones for each of the dwellings and police barracks. They are emptied and cleaned under contract. The larger ones are 15′ in diameter and 15′ deep, with concrete domes, each with an overflow cesspool. The unit which serves the large hangar, together with the offices and leased areas of the private tenants and the headquarters for the military units, is operated as a septic tank. Another of the larger cesspools cares for the American Airline terminal and the administration building, which also houses the public toilet facilities. The smaller cesspools are 8′ in diameter and 10′ deep.

That no airport is better than its drainage was learned from bitter experience in the early days of the unimproved port, when depressions became veritable reservoirs, and every substantial rain turned the entire area into a series of lakes that made operations impossible until they had dried out. When plans were made for improving the field and building concrete runways, the drainage problem was accorded primary



CROSS SECTION OF RUNWAYS

Air view of runways, Rhode Island State Airport.

considerations, and beneath the runways and the grassed portions more than six miles of pipe now form a drainage network and since it was installed, the airport has never once been closed to traffic, as the drainage system takes all surface water from the runways through catchbasins flush with the concrete which lead to under-pavement drains tied into the field drainage.

The catchbasins are concrete and brick with the drain pipes leading from them cast in place. There are 157 B. C. type catchbasins in the runways, and eight B. C. F. type catchbasins in the field drain. Those in the pavement are set 15′ from the outer edge of the runway on both sides, and are spaced 100′ apart. In addition, there are four manholes of the C. M. type in the hub of the runways and eight B. M. F. manholes in the field drainage system. Besides ordinary gate valves, at the end of each line there is an 8″ cast iron flap valve to prevent possible backing up into the system.

Under the runways are 6″, 8″ and 10″ pipe, most of it of vitrified clay of the bell and spigot type laid with open joints with the bell facing up-grade; also some reinforced concrete and asphalt-covered corrugated metal pipe. Run-off pipes are 12″, 15″ and 18″, set in screened gravel and covered with it up to the base of the runways.

Those in the French drains are covered to within 12″ of the graded surface and top soil. Near the outfalls are underdrains to furnish additional capacity. There are more than 30,000 lineal feet of drain pipe.

There are three runways, each 3,000 feet long and 150 feet wide, together with an apron 1,400 feet long and 150 feet wide, all of reinforced concrete.

In the runways the quantities of material used were: 28,635 cubic yards of concrete, 178,850 square yards of steel fabric mesh, 56,000 pounds of steel bars for tie rods, 26,000 pounds of steel bars for dowels, and 66,200 lineal feet of cork expansion joints. The total elapsed time for laying this area was four-and-one-half months.

The staff at the airport, in addition to Manager Fletcher, comprises a secretary-clerk, three maintenance men and four radio operators and meteorologists, since the control tower, which is the traffic guide for the field, is in operation during the entire 24 hours of the day. The maintenance men handle snow removal in the winter, cut grass and cultivate ornamental shrubbery in the summer, and at all times do necessary minor repairs, painting, clean catchbasins, and other general utility work.

With the renting of the hangars, and the sale of gasoline, oil and other supplies, the airport is now virtually on a paying basis, with every indication that revenue will continue to exceed cost of operation.

Pre-Construction of House Services

Few conditions of a street surface are more detrimental to the traffic than settlement of house service trenches crossing the roadway at frequent intervals. It is possible to so backfill a trench that it will not settle, but in some soils it requires more of both skill and meticulous care than it is easy to secure from plumbers or even from the water works employees. To a greater or less extent the same is true of replacing pavement over trenches. For these and possibly other reasons it is the practice in some cities, when laying a water main in a street, to lay a service connection to the curb opposite each building lot, even though they have not yet been built upon. It is usually the aim to do this a year or two before paving, or improving the pavement on, the street, during which time both main and service trenches will reach or approximate their ultimate settlement.

There are, however, disadvantages of this practice. The money invested in the services brings no returns for years; in fact, a certain percentage in many cases are never used, either because some of the assumed building lots are not built upon or because the location of the service is forgotten and it seems easier to lay a new one than to dig up the street looking for the old one. (A modern pipe finder might come in handy here.) Another important objection is that these unused services may rust through in time and leak; a number of cities have found scores of such leaking services wasting under ground very considerable amounts of water.

The advantages and disadvantages mentioned are general ones, but there may be special ones in individual cases which govern the practice adopted. This would seem to be indicated by the fact that, of about five hundred superintendents who answered a questionnaire on this subject, 24% stated that they laid service connections for all building lots at the time of laying a new main.

Department of Health Permits for Camps

The Department of Health of Maryland has notified owners and operators of all kinds of "summer" camps —labor as well as tourist and recreational—that permits showing that the camps meet the sanitary requirements of that Department must be renewed for existing camps, and new ones secured for those just starting, before the camps may be opened.

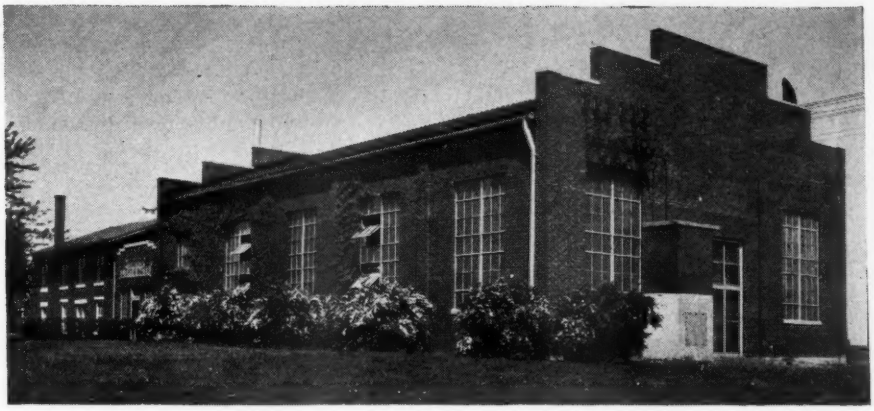
To be certified, the camp must comply with the State regulations regarding the general cleanliness of the building and grounds; concerning the water supply, toilet facilities and the disposal of sewage, garbage and other wastes. Satisfactory arrangements must also be made for proper handling of foods, milk, cream and ice cream sold on the premises. The camp regulations apply to every camp or picnic ground that is used for six days or longer and that accommodates ten or more persons.

In 1940, 298 camps were placarded, 161 of which were for tourists, 86 for recreational purposes, 44 as picnic grounds, 2 for religious gatherings and 5 as trailer camps.

Timewaster Solution

Another solution of the "unlucky 13" problem is sent by W. Leach, of Biloxi, Miss. Mr. Leach thinks this is not so far fetched as the one published in the February issue. His solution is:

$$\frac{(3 \times .3) + 3}{.3} = 13$$



View of building that houses the Cameron light plant.

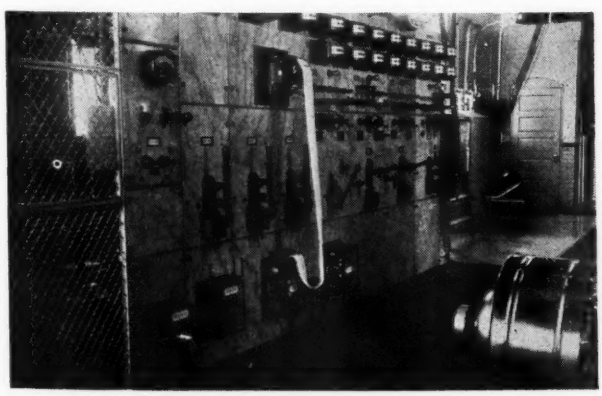
Seventeen Years of Diesel Light Plant Operation Shows Profit for Cameron, Mo.

Besides furnishing free electricity for street lights, sewer and water pumping, sufficient profit has been added to the city's general fund to permit cutting taxes in half.

By BENNETT B. SMITH

SEVENTEEN years ago Cameron, Missouri, changed from steam to Diesel power for its light plant and thus began an experiment. But after all these years the city is very favorably impressed with the success of the plant and regards it as one of its greatest assets. For the past several years, in addition to paying its own way, some $15,000 per year have been transferred from the profits to the general fund of the city to go for paying of the general running expenses. In fact, so successful has been the operation and so large the receipts, that last year the taxes in the town were reduced from ninety cents to fifty cents per $100 valuation—a cut of nearly one-half.

Recently the light rates were reduced thus giving the citizens another advantage of the city owned institution. The greatest reduction is to the user of the smallest amount of electricity, the first 25 KWH being reduced from seven cents to six cents per KWH. Over 25 KWH the price remained the same up to 750 KWH where a reduction of one-half cent was made from 3c to 2½c. For those using 2700 KWH the price was reduced from 2½c to 1½c.



The switchboard.

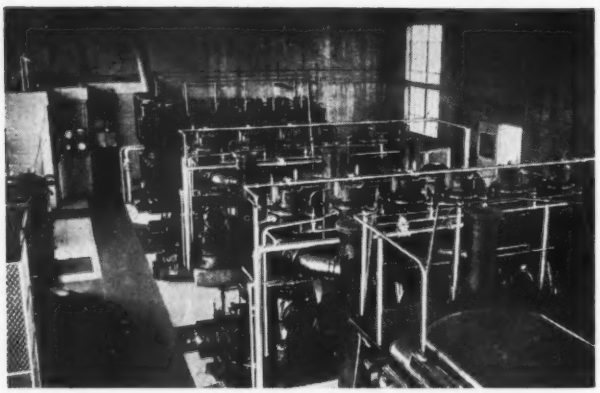
The reduction in rates will mean about $500 per month cut from the revenue but the plant is earning more than $1,500 per month in addition to the $500 put into a reserve fund. At present the city has $30,000 in the light and water reserve fund and another $30,000 which has accumulated at the saving of $500 per month. Thus some $60,000 are in reserve for an emergency.

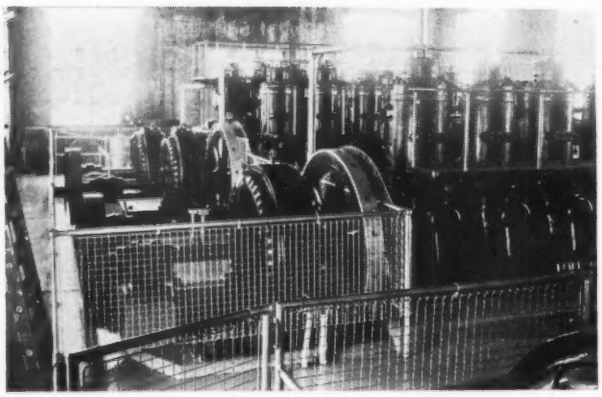
The first light plant began operation in 1893. This was not very satisfactory, but continued in service with additions for some 30 years. Then the city council began discussing a new municipal plant. Committees made trips to other towns to inspect various types of equpment. A new plant with Diesel power was decided upon. Two type Y, 300 H.P., 200 KWH. and one 200 H.P., 135 KWH. Fairbanks-Morse semi-Diesel units were purchased and the new plant began operation on October 5, 1924.

The first year saw such an increase in demand, with increases each succeeding year that it was soon discovered that larger units would be needed. This current use rose from 81,920 KWH. the first month of operation to 100,000 KWH. the following September operation.

For the production of 1,098,970 KWH. that first twelve months, 122,877 gallons of fuel oil were used at a cost of $6,023.60 and 1,867 gallons of lubricating oil at a cost of $1,186.45, a total of $7,210.05. The total cost for the year including salaries and $5.00 in repairs, amounted to $11,500. Average cost was about 1.1c per KWH. while in the old steam plant current was costing about 4c.

The load continued to increase. In 1924 the average monthly generation was 82,216 KWH. and in 1929 this had jumped to 121,930 KWH. The 135 H.P. unit was removed and a new 700 H.P., 465 KWH., Model





Two interior views of the plant.

33 Fairbanks-Morse unit was installed at a cost of $43,000.

In 1924 only 8.4 KWH. were secured per gallon of fuel oil but this increased until in 1936 it was 10.64. Total kilowatts per year with fuel oil consumed and KWH. per gallons generated are shown in the accompanying table.

The continued increase in load was responsible for the installation of another Fairbanks-Morse full Diesel unit of 750 H.P. in 1932 at a cost of $40,000. The present equipment consists of the original two 300 H.P., one 700 H.P. and one 750 H.P. units. In 1929, the 300 H.P. 135 KWH. unit was traded in.

The only repairs which have been made on the two small units during several years they have been in operation have been new rings, two new pistons, and four connecting rods. The 750 H.P. unit now has something like 70,000 hours of service. The only repair expense has been new rings at a cost of $155 and an extension shaft bearing at $45. The greatest expense has been on the 700 H.P. engine which has had the most usage until recently. During its years of operation it has had more than 60,000 hours of running and during the first days of its installation ran almost constantly. Repairs have been the rebedding of a shaft at a cost of $1,500 which was damaged when an oil line broke and allowed the pressure to go down. In July, 1937, this same unit was overhauled at a cost of $6,000 and previously had had one connecting rod replaced. In the general overhaul, new heads were added, also single stage combustion, latest type fuel pumps, and full injection nozzle.

With the completion of this work, the fuel economy increased 25 per cent, 12½ KWH. per gallon being secured instead of 9 as previously. Shut downs have been few with a total being possibly three hours in the seventeen years. There have been no stops in over two years, the last one being on November 5, 1938. Power factor runs 90% to 95%.

The cost of production last year showed a slight downward trend. Monthly cost per KWH. were:

January	.00758	July	.00663
February	.00715	August	.00642
March	.00768	September	.00635
April	.00704	October	.00649
May	.0070	November	.0076
June	.00679	December	.0078

The minimum monthly charge is 75c; up to and including 5 H.P. motors, the rate is $1.00 per H.P.; for all motors over 5 H.P., the rate is 50c per horsepower.

A large amount of free electricity is used by the city in its street lights, sewer and water pumping, lights at the municipal swimming pool, and for the rock crusher. Meter readings show 792,130 KWH. used for this purpose and, if paid for at regular rates, would amount to $9,584.66.

Total Kilowatts Generated and Fuel Oil Consumed

Year	*Tot. Kwh.*	*Fuel Oil*	*Kwh. Gal.*
1924 (3 mo.)	246,658	30,041	8.4
1925	1,098,970	128,041	8.58
1926	1,105,060	132,950	8.31
1927	1,217,560	145,766	8.35
1928	1,340,160	164,340	8.15
1929	1,463,160	173,260	8.44
1930	1,513,570	179,050	8.45
1931	1,593,090	189,240	8.41
1932	1,566,990	175,700	8.91
1933	1,636,570	181,170	9.03
1934	1,703,850	182,870	9.31
1935	1,916,350	199,350	9.61
1936	2,049,520	215,750	9.49
1937	2,111,380	204,938	10.3
1938	2,230,830	205,770	10.84
1939	2,270,850	209,140	10.88

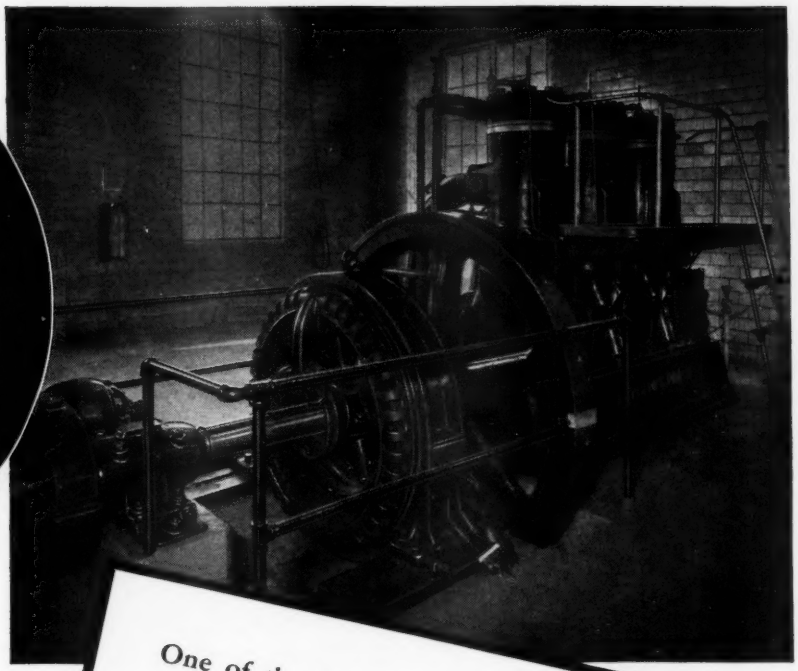
Glass Bead Pavement Stripes

The Division of Traffic and Safety of the Ohio Department of Highways has marked with a special reflectorized paint 265 miles of the highways that have had a greater than average number of night accidents, in an endeavor to reduce the number of these. On these roads, pavement stripes are applied with a so-called glass bead paint. They do not appear any different from the regular white and yellow lines in the daytime, but take on luminous appearance at night under the rays of motor car headlights. This luminosity is produced by the reflection of headlights from minute glass spheres, which are embedded in the paint. These glass spheres become embedded in the white or yellow paint and, after the paint is dry, produce a soft glow in the darkness by reflecting the headlights of cars. This reflection, in turn, increases the visibility of the white or yellow lines.

This glass bead pavement marking is particularly useful in areas covered by fogs, which make night driving extremely hazardous. Results obtained in a series of tests conducted by the Division of Traffic and Safety indicate that this type of reflectorized paint has greater wearing qualities than standard pavement marking paint. Special equipment has been developed by the Division of Traffic and Safety to apply the reflectorized paint.

It is the intention of the Ohio Department of Highways to continue the glass bead center line program through the ensuing months in an effort to make travel as safe as possible for the motorist.

Take This TIP



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It means they *know from experience* that the simple, two-cycle, slow-speed, heavy-duty F-M Diesels are *lastingly dependable* in continuous, heavy-duty service . . . that their economy of operation is derived from *both* efficient use of inexpensive fuel and *low maintenance cost.* For slow speed means slower wear, and two-cycle design means fewer moving parts and less frequent, less costly servicing. *Operating records prove it!*

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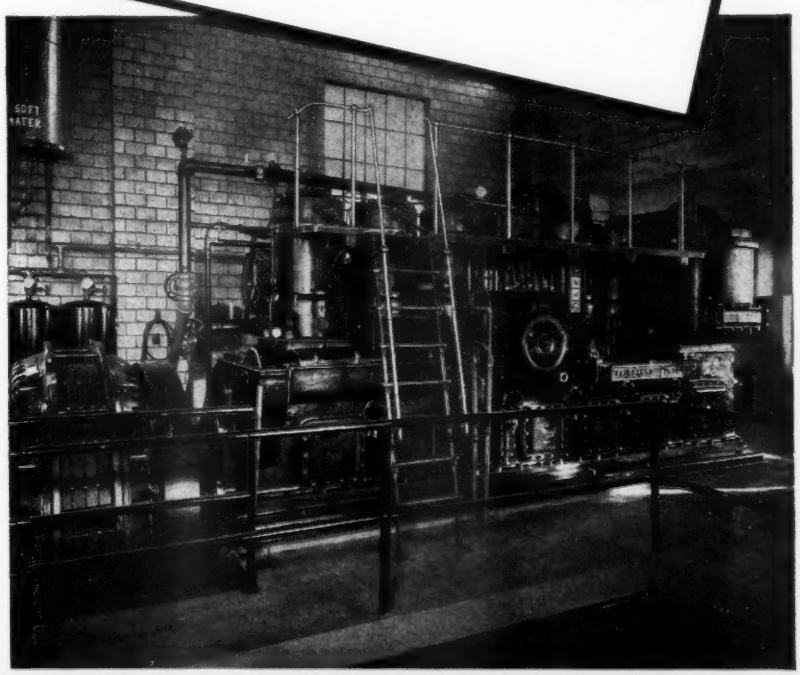
. . . when expansion was required this new, larger, heavy-duty F-M Diesel was the obvious choice.



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Index

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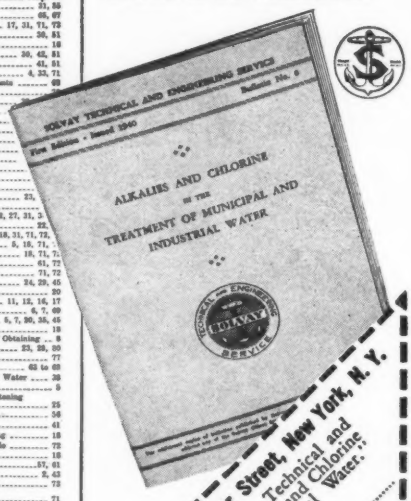

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Locating and Stopping Water Waste

(Continued from page 12)

pumped out of the station should be accurate and should be tested for accuracy every few years. A daily record of water pumpage and power or fuel used should be accurately kept. We plot curves, showing the water pumped, power used, comparison of night rate to total pumpage and K.W.H. per M.G. and we find that they are of great help to us, as one can see at a glance if there is an unusual demand upon the system.

We do not feel that it is necessary to deal with those leaks that show at the surface of the ground, as anyone, even with no experience, can locate these. Our meter reader has instructions to listen at all times, when reading, for noises that would indicate a leak in the immediate neighborhood. We have discovered many leaks in this way, and an alert meter reader can be of great benefit to the department, if he will report all unusual noises. We make a monthly trip around to all of the hydrants, listening with the telephone receiver type detector on each hydrant. This, necessarily, must be done at night, as outside noises during the day make this test useless. Many leaks have been discovered in this way and for a quick check-up on the system, we believe that it is very much worthwhile.

The writer also is connected with the Sanitary District and consequently has access to the records, showing the amount of sewage flow at all times, and this fact has been of inestimable value to the water department in locating leaks. Our sewerage system and flow is of such a nature, that the amount of sewage is reasonably constant at all times, except during periods of heavy rainfall. Consequently, we can tell when there is an unusual flow through the sewers and can also tell approximately from which part of the city this is originating. During the past month, there was a leak of 200,000 gallons per day located and repaired, and the district from which it was coming was given to the water department by the unusual flow through the sewers. The water department had been listening at night trying to locate it and had run it down to a hydrant just one-half block away from where the leak was found. So, if there is no direct connection between the personnel of the Water and Sewerage departments, arrangments should be made to establish one, as it is perhaps one of the most important that a water system could have.

We have a leak detector, that we use for locating the leaks after the territory has been found in which the leak exists. However, it is not of the latest type, but it has been of great help in locating the leaks. Every modern water department should have a pipe locator and a leak detector and should train one individual to operate these instruments, as it requires a lot of experience to use these properly and if every Tom, Dick and Harry in the department are using them, the results obtained will not be satisfactory. After locating the approximate location of a leak, we have occasionally used a post-hole digger with good results, digging several holes down to the main or service and listening at each to get the point of the loudest noise. This briefly describes the methods we use for locating underground leaks and while we are not as fast as the regular established leak detector engineer, we feel that we have producd results worthwhile, as we have held our night rate down to approximately 38% and have located

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leaks amounting to probably 600,000 gallons per day since our original survey was completed. However, it is a problem that we will always have, and one must be constantly on the watch for unusual signs that would indicate leaks in the system.

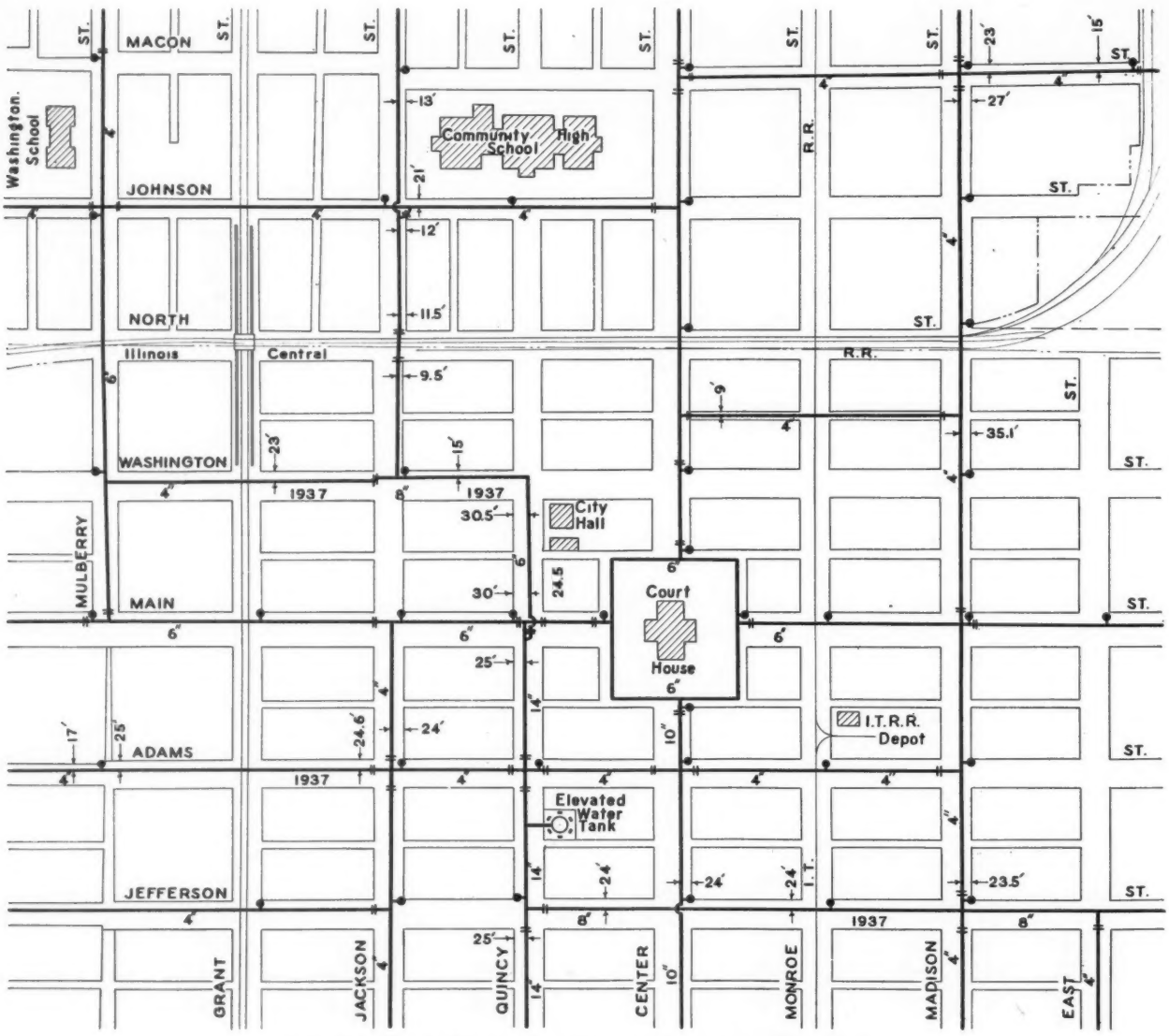
In our work we have discovered that the most common source of leakage is the galvanized services and lead goose necks. Consequently, we would suggest that all galvanized services be discontinued and copper or lead used instead. We find that a galvanized service, after ten years, is very liable to develop a leak and if it should happen to be over a sewer, it might not be detected until the loss of pressure to that particular customer brings a complaint to the department. All abandoned services should be shut off at the main and not the curb cock, as we have found many leaks that develop between these two points. Occasionally, we have found leaks at the joints of the cast-iron mains, but this is rather rare, and we have never had a case of a leak due to failure of the cast-iron main itself. When a new service is being installed, it should be watched carefully to see that it is properly supported and that it will not be subject to strain in the event that the earth settles away from it. Services should never be laid in the same ditch with the sewer, as we find many leaks going directly to the sewer below.

Present Practice in Reducing Water Waste and Testing Meters

A Survey by the Editors of PUBLIC WORKS

IN OUR March issue we gave a summary of replies received from several hundred water works superintendents to a questionnaire dealing with methods employed for reducing waste of water, and the practice as to testing of meters. We give below many of the individual replies, grouped by states, which give a more detailed idea of several practices; with the effect, if any, of geographical location thereon.

Phil J. Martin, Jr., Supt. City Water Dept., Tucson, Ariz., reports that waste is reduced by having their system 100% metered. "Our meters are not tested unless the bill is above or below the average," says John



Map of center of Clinton, Ill., showing details of distribution system.

Waterworks Men, On to Toronto!

Host to 61st Annual Convention American Water Works Association, Royal York Hotel, June 22-26

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R. Peavy, Supt. of Water Works for Mobile, Ala. In Tuscaloosa, according to C. S. Read, Supt., meters are tested after repairs or removal and are checked for leaks when pumping costs appear to be too high; services are checked when meter readings increase to a point higher than normal. E. Motsch, Light Manager of Marianna, Ark., checks the daily pumpage against the flow in the sewers and ditches. H. B. Carruth, City Engineer, Nashville, Ark., tests meters when they are removed; wastage is reduced by means of monthly checks on leaks, keeping records and curves of pumping, consumption and efficiencies.

In Pittsburg, Calif., Robert L. Heck, superintendent of the municipal purification plant, considers that the checks on night flows may indicate losses of minor consequences; the unaccounted for water includes flushing sewers and mains. Frank E. Alderman, City Engineer, South Gate, Calif., has installed Sparling meters on all wells to determine production, and this is checked monthly against sales. (Ed. Note: Looks like a fine idea.) Fort Collins, Colo., Burgis G. Coy, City Engineer and Supt. of Water Works, inspects for waste during the irrigating hours—the customers are allowed to irrigate from 5 A.M. to 9 P.M. each day. Martinez, Calif., O. K. Smith, City Engineer, says they reduce waste by watching levels in the reservoirs and tanks in comparison with gauges, locating all seepages and by instituting repairs immedately. City Engineer Geo. S. Hinckley, Redlands, Calif., states that waste is reduced by metering all but public-owned services. E. O. Imus, City Engineer, Oxnard, Calif., reports that his city reduces waste by inspecting all plumbing fixtures within the city once each year, issuing notices of needed repairs on all faulty fixtures and rechecking faulty fixtures. In Palo Alto, Calif., M. S. Noble, Supt. Water Division, a water leak survey of the entire distribution system is made every other year by the use of the "Fisher M-Scope" method; a number of leaks have been found in the mains and many services have been replaced prior to complete failure.

H. C. McClintock, City Manager, Boulder, Colo., reports that they reduce waste by instructing the police to watch for waste during lawn sprinkling season, sprinkling being allowed for three hours in the morning and evening every other day. Caleb Mills Saville, Manager and Chief Engineer, The Water Bureau of the Metropolitan District, Hartford, Conn., notifies consumers of excessive consumption and carries out an annual pitometer survey, which is followed by repair of all leaks detected. In Southington, Conn., S. W. Bowers, Supt. and Engineer, a house to house inspection of all fixtures is made every two years. G. D. Armstrong, Commissioner of Public Works, Bradenton, Fla., says that means of locating leaks are not needed, since the pipes are in shallow trenches and a leak of any importance shows up very soon. Supt. of Distribution B. P. Hitchcock of Winter Haven, Fla., says that in order to reduce waste they are installing Venturi tube meters to give them more accurate pumping figures.

Waste has been reduced by strict and careful supervision of the distribution system in Buford, Ga., Vernon W. Crawford, City Manager, and meters are tested upon complaint of the customer. Waste is reduced in American Falls, Idaho, T. C. Sparks, City Clerk and Water Supt., by the threat of metering and by insistence on the repair of fixtures, with water shut off as a penalty for non-compliance. In Preston, Idaho, there are hours when sprinkling is permitted and a close check is kept on these. C. I. Goff is Supt. of the Water Department.

Belleville, Ill., Wm. A. Gray, Staff Engineer, reports

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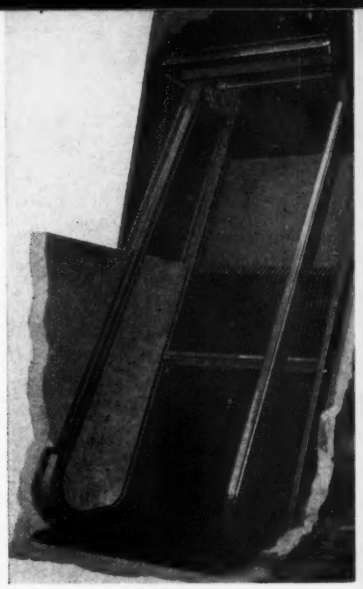

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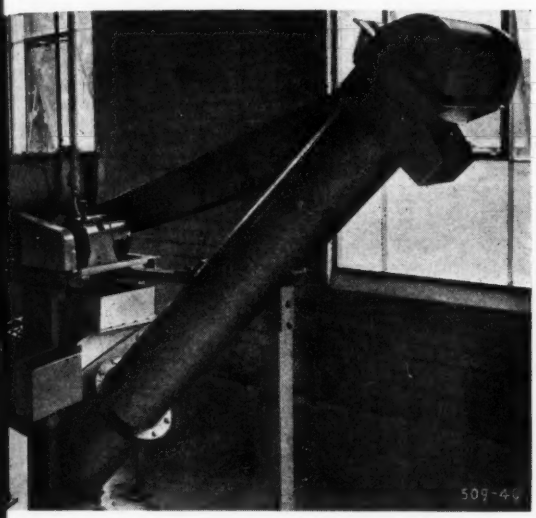

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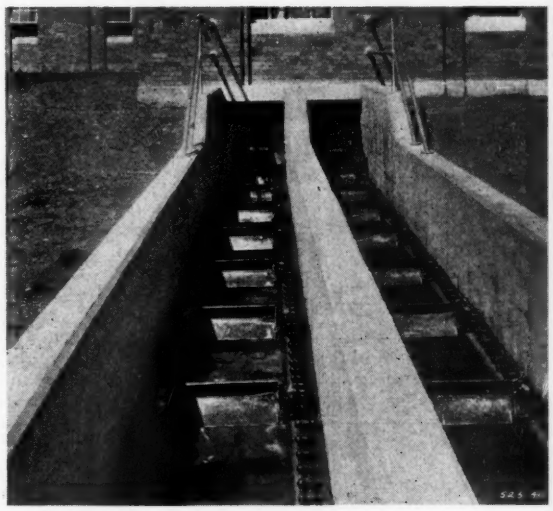

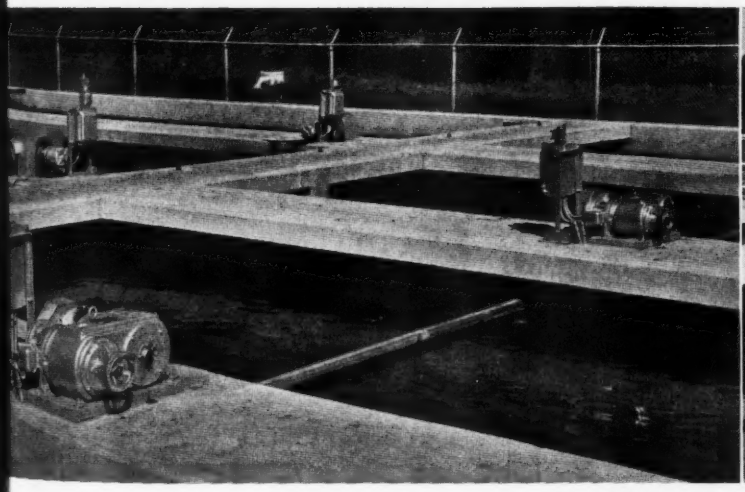

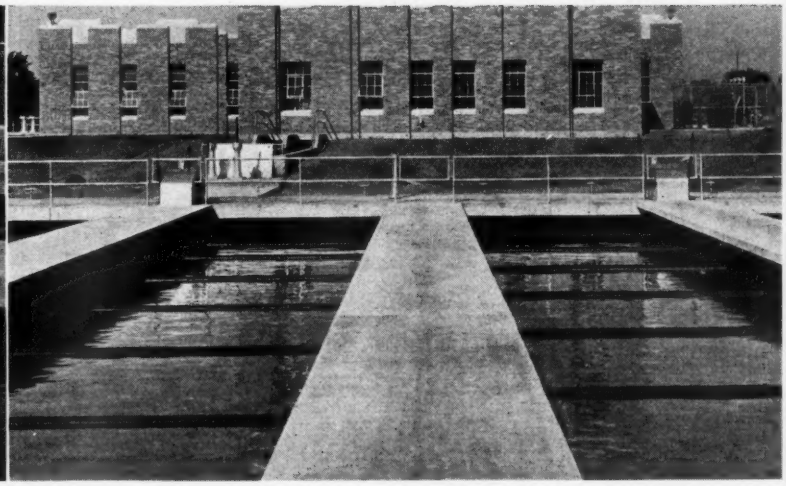

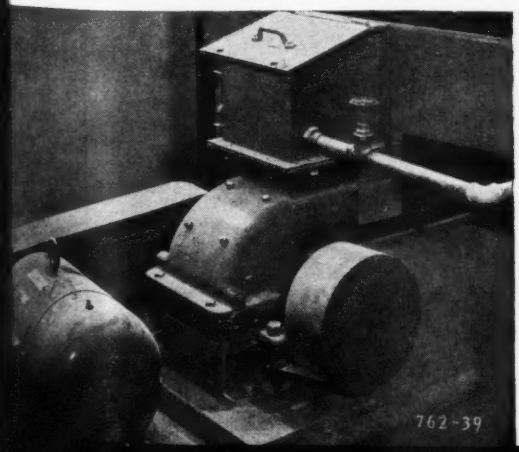

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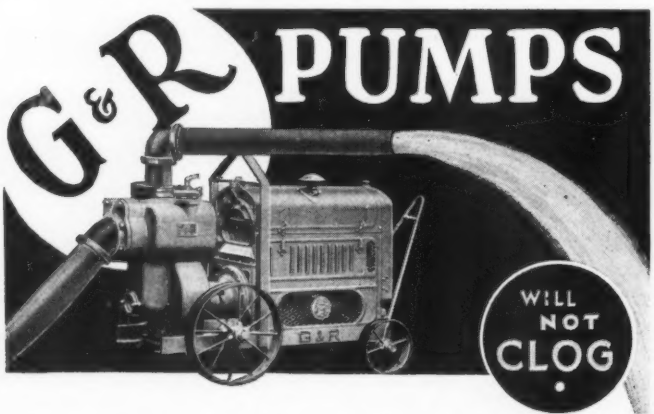
that meters are tested when repaired—not less often than every three years; waste is reduced through continual inspection of valves and hydrants. The regular program at Clinton, Ill., C. E. Corrington, Commissioner of Public Property, includes listening at hydrants; listening by meter readers; a careful check of the water pumped; a daily comparison with the sewage flow; and pitometer surveys—the last being made two years ago. Mr. Corrington has made a very fine record for reduction of waste and a summary of some of his methods appear elsewhere in this issue.

Ernest B. Lloyd, Chief Engineer and Chemist, Elgin, Ill., says: "We have an ordinance prohibiting water waste; we have one of the best meter repair shops in the country and we buy only the best meters; we are on the lookout for leaks continually; we have an excellent leak detector and the men are carefully trained to know how to use it." In Normal, Ill., Edwin F. Smith, City Engineer, a program to test and repair or replace all meters in use is just starting; a house to house canvass to locate leaks in mains and services is being carried on concurrently. The meter reader, in Riverside, Ill., G. L. Opper, Village Manager, checks the service pipe with an Aquaphone at the time of each quarterly reading. E. MacDonald, Supt., Northern Illinois Water Corp., Sterling, Ill., reports that the meter reader listens with a Sonoscope and almost invariably locates any leaks.

Supt. of Water and Sewers, Jos. O. Forten, Glen Ellyn, Ill., says they reduce waste by an annual check of all valves, hydrants, and services, both vacant and improved property. Rockford, Ill., H. S. Merz, Supt. Water Dept., states that waste is reduced by requiring good construction work with good materials. Michael C. Fuerst, Supt. Public Works, Skokie (formerly Niles Center), Ill., states that an engineer checks for leaks by blocking off squares using a Simplex meter; also by localizing leaks in small areas and checking same. Charles Berlin, Supt. of Water, Bridgeport, Ill., states that they check for leaks by keeping an engineer on the job all of the time. G. J. Woodhouse, Supt. Municipal Utilities, Harlan, Iowa, reports that waste is reduced by checking the flush tanks on the sewers, and by repairing all leaks promptly. City Clerk C. C. Williams, West Des Moines, Iowa, says they reduce waste by the installation of a meter on each pump. Creston, Iowa, Supt. and Engineer Arthur K. Olsen states that he has eliminated all galvanized pipe in their system. In Indianola, Iowa, V. E. Knight, Supt. and City Engineer, says that they make constant inspections for leaks with listening devices and by checking sewerage flow, and receive cooperation from the plumbers. City Manager Edwin E. Jenkins, Villisca, Iowa, has the readers listen in on services by means of a hand phone at the time of reading the meters; they watch gauges and check up by going over the territory.

R. J. Duvall, Elec. Engr. and Asst. Manager, Board of Public Utilities, Kansas City, reports that occasionally they use an electrical leak locator, close supervision being kept of mains to detect service leakage. Supt. Roll Ginter of Newton, Kans., reports that they are making a very accurate survey on all meters, which must test within 2%, plus or minus; they are also making a survey of leaks, fire hydrants and flush tanks. Rayne, La., E. J. Bertrand, Supt. Water, Light and Sewerage, says waste is reduced by checking closely for leaks on valves and hydrants and also by metering schools and public buildings where water is furnished free.

Wm. P. Melley, Supt. Water Works, Milton, Mass.,



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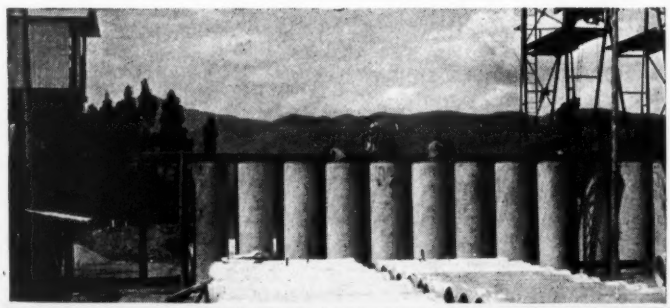

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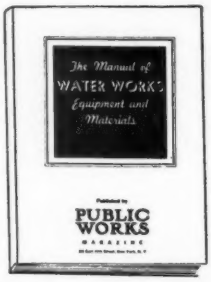

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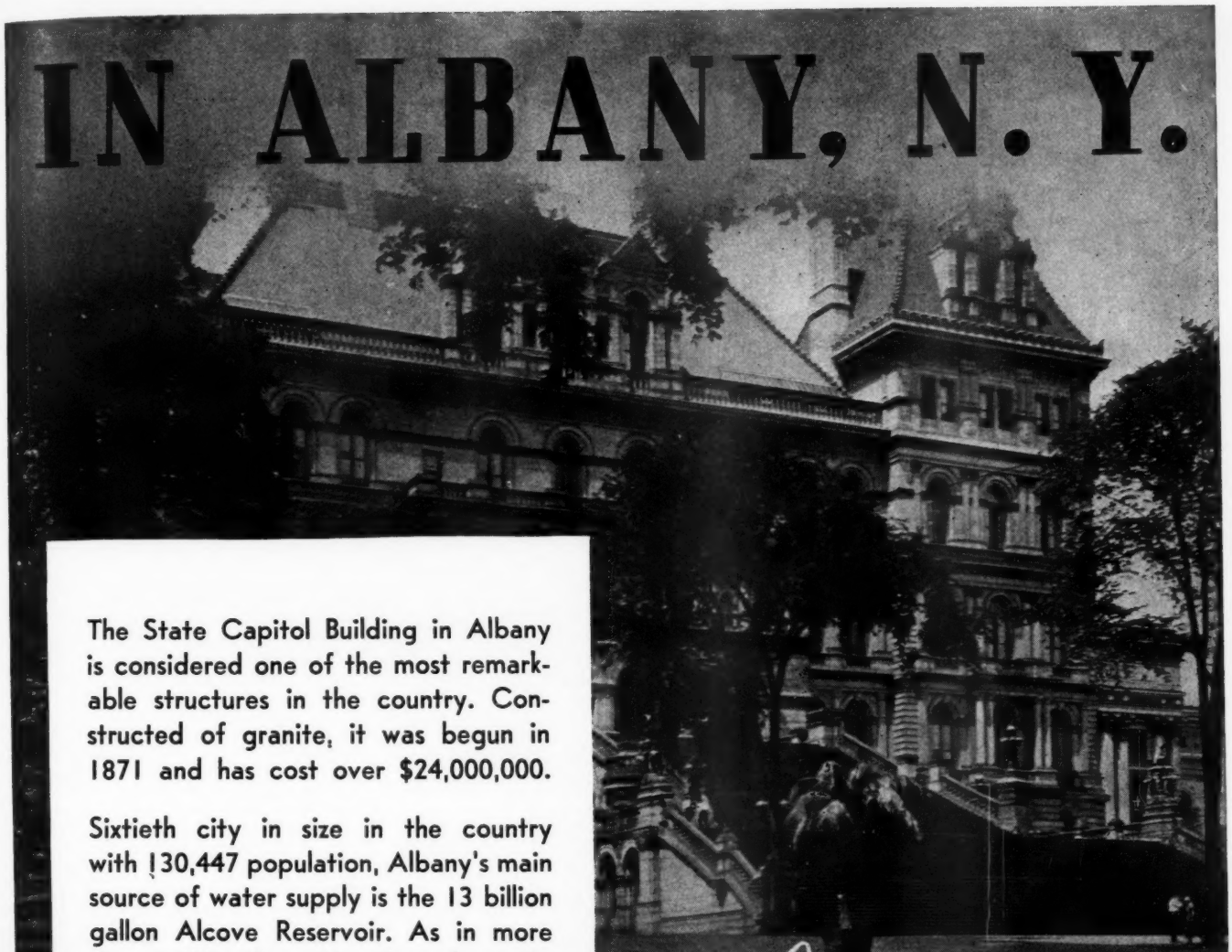

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periodically removes and tests meters and junks old meters; leakage is checked by close attention to registration of master meters.

Danvers, Mass., Roger W. Esty, Supt. of Water Works, states that waste is reduced through 100% metering; they check the town in districts every other year for night flows by means of meters, meter master recording device and pressure gauges. Leon A. Goodale, Supt. Bureau of Water, Worcester, Mass., reports that meters are tested when consumption falls off; and waste is reduced by keeping a careful check on consumption.

In Grand Rapids, Mich., according to Jos. J. Wernette, Supt. and Chief Engr., Dept. Municipal Water and Light, a leak detector is in use all the time, and leaks are located and repaired promptly. In Ann Arbor, Mich., Manager H. H. Caswell states that they make immediate repairs, and that the meter readers make continuous inspections for noises. "We rely on general inspection and observation with continuous activity of our Electric Dept., meter readers, inspectors and service men," says L. E. McQueen, Supt. Bd. of Public Works, Coldwater, Mich.

The Supt. of Water Supply, E. L. Holloway, Flint, Mich., says that they make frequent inspections of lines; also a monthly check of distribution meters against the master meters at the pumping station. Earl E. Norman, Supt. Public Utilities of Kalamazoo, Mich., reports that they make Pitometer surveys, and watch carefully the accuracy and the size of meters. South Haven, Mich., S. H. Smith, Supt. Bd. of Public Works, states that meter readers listen for leaks when reading the meters every month, using the aquaphone.

In Minneapolis, Minn., J. A. Jensen, Supt., Water Dept., Pitometer surveys have been made, and the work is continued by the leak inspector. Eugene Schwarz, Supt. Water Works, Rochester, Minn., says that, their services being nearly 100% metered, waste is very small, and that leaks in services are repaired as soon as they are located. Gen. Mgr. Herbert S. Grove, Stillwater, Minn., reports that the meter readers make inspections in their spare time. According to W. T. Meseck, Supt. Municipal Utilities, Austin, Minn., pumps are checked against the metered consumption to reduce waste.

Supt. of Water and Light Dept., Fred F. Williams, Poplar Bluff, Mo., says a yearly house to house survey is made in order to reduce waste. Boonville, Mo., Supt. Water Dept., Major C. Hagar states that inspections for leaks are being made continually. W. H. Dewey, Supt. Water Works, Springfield, Mo., says that their entire system is checked continuously by one man. Water Com'r Forrest G. Bayerd of Dillon, Mont., reports that when the meters are read, the reader listens for leaks, and orders all leaks to be repaired promptly; flat rate customers are also checked in the same way. In Melstone, Mont., Harry J. Field, Waterworks Supt., reports that in order to reduce waste they replace services with copper and mains with cast iron. A. C. Hahn, City Engineer, Fallon, Nevada, states "This being a sandy country, a leak detector more than pays for itself; a close check is kept on street sprinkling and the water used for flushing sewers."

In Crete, Nebr., D. J. Drake, Light and Water Commissioner, states they try to keep a record of all water used for flushing hydrants, and also that used by the fire department. Theodore L. Cate, Supt. Water Works, Lakeport, N. H., checks for leaks with an aquaphone and a leak detector. Borough Engineer F. E. Harley, Fairlawn, N. J., states that their system is 100% me-

tered and that waste is automatically taken care of by the property owners. In Montclair, N. J., Asst. Supt., Chas. G. Bourgin reports, a leak survey was made in 1940; also that the meter readers check the system four times a year and the hydrant foreman twice a year. Earl E. Mader, Engr., Water Dept., Passaic, N. J., says that grid mains are exceptionally tight; they send postcard notices to the consumers when their bills are high or after inspection shows probable leakage.

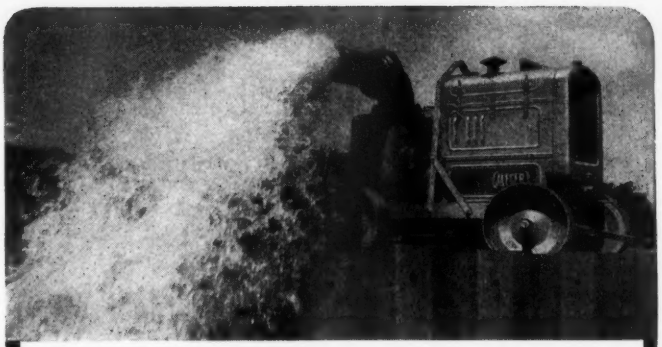
Deming, N. Mex., "There is no ground water so that any leakage shows up as moisture," A. J. Noyes, Supt. Water and Gas Dept. Water Dept. Mgr. Alvin C. Southard of Freeport, N. Y., says that for about two years they have been enforcing metering of every new service. H. S. Andrews, City Engr. and Comr. of Pub. Works, Fulton, N. Y., states a careful check is made by meter readers four times a year, and they have also made one Pitometer survey. In Geneva, N. Y., J. W. Brennan, City Engr., when water pumped exceeds the metered consumption by more than 75%, a survey for leaks is made. Larchmont, N. Y., Henry T. Hotchkiss, Supervising Chemist, reports that wastage is reduced by having checks made when bills are high; meter readers and police watch for leaks; and also by observance of sewer and catch basin flows.

Commissioner of Public Works, Howard D. Sage, Mechanicville, N. Y., states that they make checks on pumping, and that the meter readers use the aquaphone four times a year. Clarence F. Ames, Supt., New York Water Service Corp., Norwich, N. Y., says that meter readers report all unusual service noise. Ossining, N. Y., Wallace T. Miller, Supt. Bd. of Water Comm., reports that on the distribution system an almost continuous leak survey is made by listening on all hydrants, valves, and service connections when operating; by listening at each meter at time of reading; curb shut-offs are checked for operation and leakage more or less continuously at a rate to provide complete coverage of the system at least every five years; on consumer's property by immediately investigating any unusual increase in registered consumption. In Waterford, N. Y., R. G. Yaxley, Supt. Water Works, by aquaphone and geophone surveys, all services being aquaphoned by meter reader at each reading; and by keeping a check on the storage on Sunday mornings. Hamilton, N. Y., Supt of Public Works Robert H. Albrecht says they reduce waste by replacing their old meters with Pittsburgh I.M.O. Meters. Supt. of Streets and Water Works, Hugh Pierson of Wolcott, N. Y., says they reduce waste by closing the valves that are in the flow line.

McKean Maffitt, Supt. Water and Sewers, states that Wilmington, N. C., utilizes sporadic inspection and checks when consumption shows signs of an unaccounted for increase. Supt. of Water Works W. J. Littlehales of Dickinson, N. Dak., checks "When plant meter and service meters do not balance." Fargo, N. D., W. P. Tarbell, City Engr., states that they listen at meters, gates and hydrants.

In Akron, Ohio, W. R. LaDue, Supt. and Engr., a periodic visual check of valves, hydrants and curb boxes is made, and meter readers' reports are checked. J. H. Beatty, Supt., Water Works, Eaton, Ohio, reports that the meter readers test all lines at curb valves for leaks during their spare time. Chief Engr. Geo. L. Kirk, Lima, Ohio, says they check by use of meters only, and if the consumers waste water they must pay for it; they have no waste except evaporation in reservoirs.

Lorain, Ohio, Henry F. Alexander, City Engr., keeps a crew on continual inspection of mains and services. Arthur L. Schmidt, Chief Engr., Div. of



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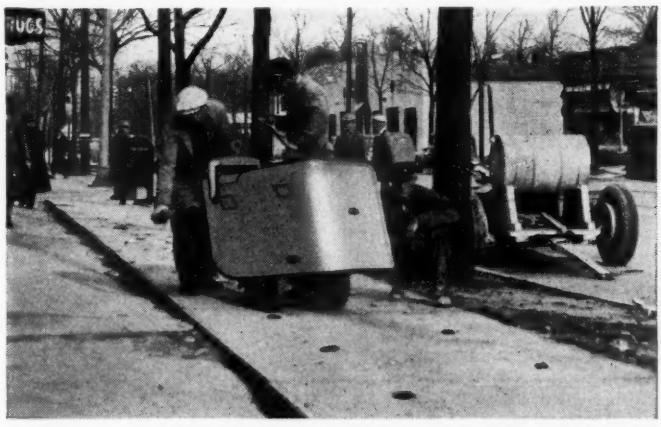

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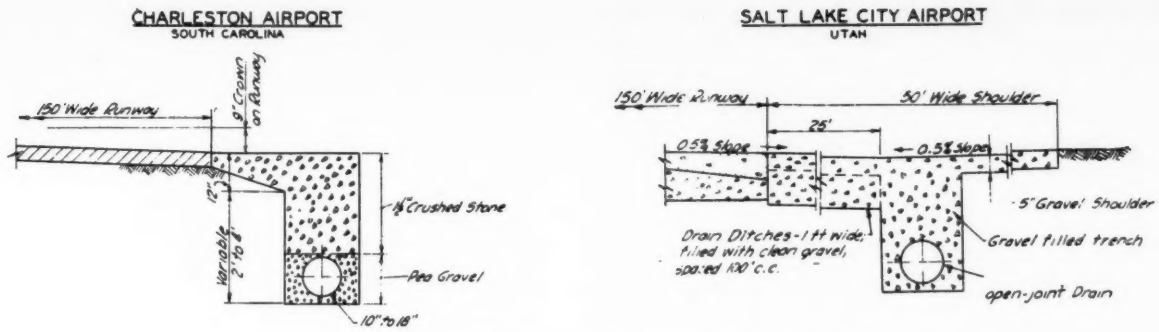
Water, Youngstown, Ohio, states that two crews of leak finders have a yearly job of locating leaks, and notifying owners to repair them if inside curb. In Lima, Ohio, according to Edward Ephraim Smith, Gen'l Supt., Dept. of Water and Sewage Treatment, an annual leak survey is made after hydrant inspection and after the frost hazard is absent.

Plant Superintendent, H. M. Frye, Blackwell, Okla., states that they have the waste problem well in hand; they have no leaks and all of the water is accounted for. Pumping Plant Supt., W. H. Hollingsworth, Edmond, Okla., checks by inspecting flush tanks and by use of listening devices on mains.

Catasauqua, Pa., L. J. H. & L. Phaon Grossart, Town Engineers, report that when daily consumption is abnormally high, investigations are made, and an appeal is made to the public through newspapers. In Scottdale, Pa., R. L. Tyler, General Supt., carries on yearly sectional inspection and quarterly Sonophone soundings by meter readers. Wm. Bache, Supt. Water Works, Wellsboro, Pa., states that house fixtures are inspected, and the aquaphone used on mains. Chief Engr. Charles L. Fox, Wilkinsburg, Pa., says that an annual Pitometer survey is made. Chester, S. C., City Engr. J. H. McLure, reports that they watch conditions, and that the high rate discourages waste by customers. Richard Curtis, Water Supt., Deadwood, S. Dak., says they reduce waste by rigid inspection and check plumbing, service lines and mains. Flandreau, S. Dak., F. L. Thomas, City Engr., reduces waste by checking services every three months. Office Engr., W. T. Whitaker, Knoxville, Tenn., states that they make a continuous leakage survey with a Geophone. J. P. Tackett, City Mgr., Graham, Tex., continues inspection of flat rate service and urges metering all services, whether paid or free water. In Houston, Tex., G. L. Fugate, Chief Engr., the Water Dept. does not have a waste water survey crew; a special crew is assigned to investigate cases of apparent illegal use of water.

R. L. Blankenship, Town Manager, Orange, Va., states that they reduce waste by having the system 100% metered, installing new services of copper pipe, and keeping an accurate account of water pumped and used by the town. B. C. Gosney, Supt. Water Dept., Auburn, Wash., reports that customers are limited to one sprinkler or nozzle from 6 to 9 A.M. and P.M. Wheeling, W. Va.,, A. W. Foster, Water Cost Clerk, states that during their spare time they make a survey of the entire water system with an electric leak locating outfit, and that leaks are repaired as soon as they are detected.

Supt. of Water Works Wm. U. Gallaher, of Appleton, Wis., says they make frequent checks for noises from leaks. J. W. Myers, Jr., Supt. Water Works, Kenosha, Wis., reports that a water waste survey was made in 1938 by the Pitometer Co., followed by periodic testing of large industrial meters and a constant search for service leaks by meter readers; 88.55% of their pumpage is unaccounted for on consumers' meters. Milwaukee, Wis., Henry P. Bohmann, Supt. of Water Works, says waste is reduced by metering of services and maintenance of meters; also by inspection of unmetered services and hydrants and by immediate repair of leaks in mains and service pipes. Rhinelander, Wis., T. M. Wardwell, City Mgr., states that they made one leak survey, and that the flat rate system does not permit much of a basis for checking leakage. H. G. Watson, City Engr., of Cheyenne, Wyo., says by prompt repair of leaks and educating the public regarding value of water, unaccounted-for water is reduced.



Typical drains under runway shoulders at Charleston and Salt Lake City airports.

Principles of Design of Airport Drainage

Subsurface drainage and removal of surface runoff, with provision of maximum reliability of operation with minimum difficulty and expense and adaptability to future expansion

AIRPORT drainage partakes of the nature and problems of: (1) highway subdrainage, in which the purpose is to control underground or subsurface water and prevent it from causing damage to the road surface through frost heaving or weak spots in the subgrade; (2) storm drainage, where rainfall is removed rapidly during and immediately after a rainfall, to permit streets to be used and to prevent damage from flood waters; and (3) agricultural drainage, which is intended to maintain the ground surface in a moderately dry condition. It differs from them in that open ditches and gutters are inadmissible, as the entire surface of the airport should be smooth enough so that a landing can be made, if necessary, other than on the runways, and drains are subject to wheel and impact loads in excess of those found in farm lands or even highway structures.

Experience has shown that it is possible to accomplish all of these objectives, in most cases, by a single system, which acts both as a storm sewer and as a subsurface drain. This is possible because storm water is ordinarily removed within a short time after the storm has passed, and the inability of the lines to function as subdrains for this brief period is relatively unimportant. The subsurface water is maintained at a safe level at all times by the drainage system. and the rain water that percolates into the soil does not reach the drains until the storm runoff has been carried away. Thus, a properly constructed system performs all three functions.

In outline, therefore, an airport drainage system will consist of a main network of pipes to carry off the storm water, with laterals joining the main system whose function it is to remove subsurface flows. The design of such a system is not unusually difficult, but there are a number of factors to be considered in order to comply with the various demands that the system must meet.

According to U. S. Army practice[1] airport drainage should be designed to provide the following:

a. Adequate subsurface drainage of the airport area to assure stable soil conditions necessary to provide the required load-bearing capacity.

b. Removal of surface runoff that would result from the selected "design" storm, without damage to field facilities or significant interruption of normal traffic.

c. Removal of surface runoff from storms greater than the design storm with the minimum damage to field facilities and with the shortest interruption to normal traffic that is practicable.

d. Maximum reliability of operation practicable under all climatic conditions.

e. Minimum maintenance and operation difficulties and expense.

f. Adaptability to future expansion of airport drainage facilities with the minimum of expense and interruption to normal traffic.

A consideration of these factors will indicate that airport drainage design is not fixed, but that each case requires the exercise of engineering judgment and knowledge, sound construction and the use of suitable materials.

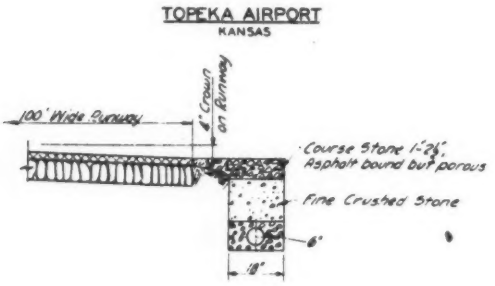
Basic Design Data

Time and money spent in acquiring essential basic data usually represent a good investment. These data should include[1] (1) a contour map of the area covered by the airport and of adjoining areas that may contribute runoff; the contour interval for the airport proper should be 1 ft.; (2) a layout map of the airport, showing the location and dimensions of all runways, aprons, buildings and other structures; (3) a drainage subdivision map showing the controlling drainage area boundaries as they will be after the airport has been brought to final grade; on this map, the general plan of the drainage system should be shown; in some or many cases these data may be shown on the layout map; (4) profiles along the center lines of runways and aprons, with representative cross-sections; and, when available, profiles of the drains, with invert and ground elevations; (5) data on outlet conditions, especially where back water may affect dis-

charge; (6) temperature records, showing high, mean and low temperatures by months, and depth of frost penetration; (7) snow-fall data; (8) rainfall-frequency data; (9) soil profiles, showing the various types of soils and the water table; (10) information on the types of pavements to be used, and their characteristics as regards watertightness and resistance to flow.

General Design of Drainage System

In preparing the layout of the drainage system, full consideration should be given to its dual function. It must operate as a storm drain during periods of rainfall, and the main lines should therefore be laid along direct courses. Principal collectors or laterals should be located to drain important points; that is, the surface flow of water to a sewer inlet should be short. In practice, this means that either mains or submains should be placed along each side of every runway, and along the edges of taxi-strips and aprons.



Subdrain at Topeka airport.

Since the unpaved areas should, in general, slope away from the runways, a submain should be placed in the lowest areas between the runways.

This layout forms the skeleton of the drainage system and it should be supplemented as may be necessary by other lines in order to remove both storm water and subsurface water.

Consideration should also be given to surface and subsurface flows from adjoining areas. Wherever possible, it is desirable to divert these flows. In any case, a careful study should be made of the influence of such flows on the airport drainage system and the methods possible for handling them.

The spacing and depth of the subdrains required will be discussed more fully under "subdrainage." These factors are closely related to the character of the soil.

Collection of storm water may be by means of channels extending parallel to the edges, and along the full length, of all paved areas, or by storm water inlets, or by both. There are numerous variations in the methods employed. Perhaps the most commonly used method is to lay drainage pipe in a trench backfilled with porous materials along each edge of the runways. This trench, during dry weather acts as a subdrain, but during rainfall it becomes a continuous interceptor for the flow from the runway, the surface of which is crowned slightly (6 to 9 ins. for a 100-ft. runway, and correspondingly more for wider ones.)

Such drains are placed at the depth required by design factors; the porous backfill is continued to the surface; or to within 6 ins. of the surface, with a final cover of porous top-soil; or a continuous grating is

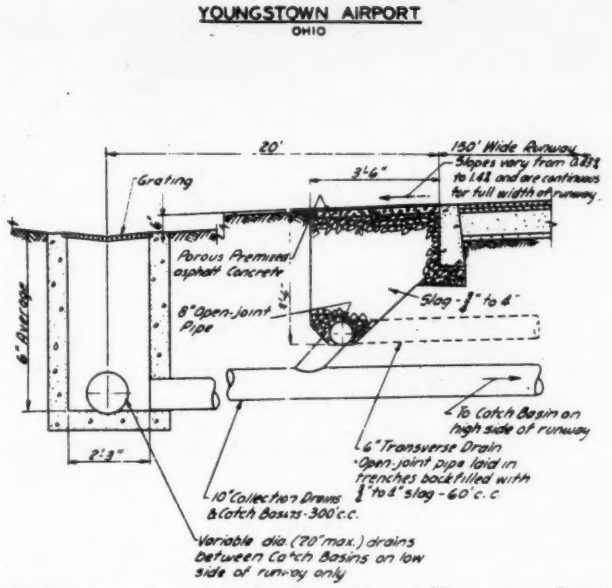
placed over it to permit free entrance of the water; or shallow channels, covered with grating may be placed at the edges of the runways and these channels carried to storm sewer inlets, the subdrain system in this case being separate and discharging into the same storm sewer.

The distance between such collecting drains or channels for storm water is determined by the maximum depth of water permissible on the areas under consideration. The depth of such water is affected by the intensity of rainfall and by the slope of the surface, the distance of flow that is required to reach a drain or inlet, and the surface characteristics affecting resistance to flow. The permissible depth of ponding must be estimated after consideration of the requirements for uninterrupted service at the field.

Design of Storm Drains

The design of the storm drainage system will be carried out in the same manner as for municipal storm sewers. The selection of the intensity of rainfall must be governed by local considerations; it is seldom that a storm with a frequency of occurrence less than once in ten years should be chosen. Often, it will be five years or less. The system may be designed to remove all the water within 2 hours after the storm has ceased, or within such other period as local conditions may require. A surface drainage system of this type will usually be running at maximum capacities in 45 minutes or less after the rain has started.

O. C. Carter [2] studied and reported on a large number of storms at the Columbus, O., airport. His conclusions were that 40 minutes would be a representative figure of the time of concentration at this airport



Catchbasin, surface and subsurface drains at Youngstown airport.

which at the time of the study had an area of 170 acres. The lowest time of concentration was 23 minutes, and this flow was affected by a large amount of runoff from a previous crest of the same storm.

Runoff from paved areas will be 85% to 100% of the rainfall and from sodded areas 10% to 25%.

Subsurface Drainage

The maximum discharge from a subdrainage system usually occurs 4 to 6 hours after a heavy rain of short duration. Thus, except in long-continued rains,

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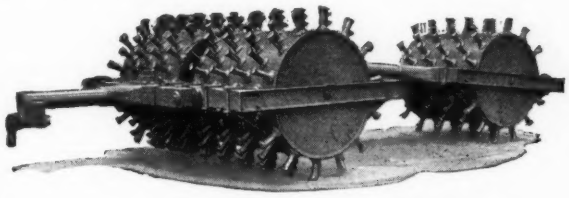

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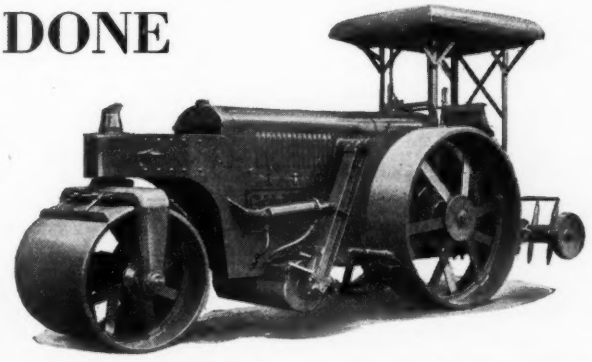

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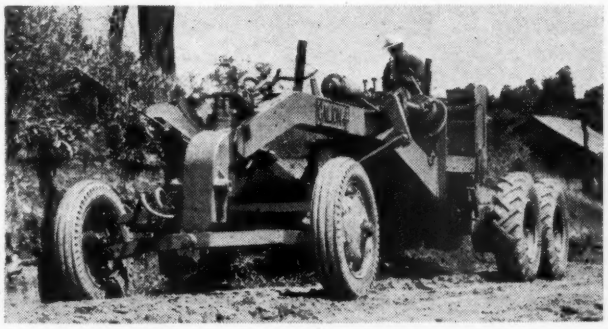

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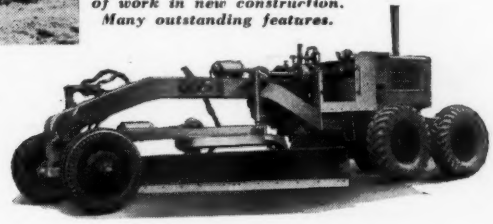

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the needs for surface and subsurface drainage do not conflict. The amount of subsurface water is small, consisting generally of that which percolates into the ground during a rain, less that lost by evaporation and used by grass. Experience in agricultural drainage [3] has shown that subsurface runoff for average soils may be assumed as 5/16 to 3/8 in. per 24 hours.

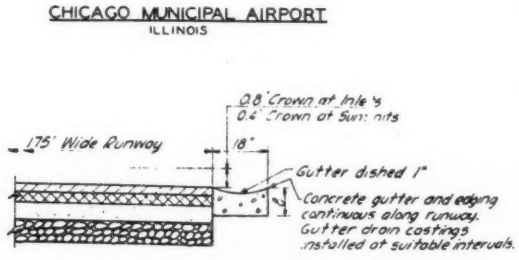
Practically every type of soil will require some subdrainage [1]. If the only purpose of a subdrain is to lower the water table, the depth of the collector pipe can be less than it would be if required also to eliminate capillary saturation. In most soils, a reasonable depth of trench on either side of the normal runway will give satisfactory drainage. Wider runways, unpaved usable areas and "all-over" fields will require subdrain depth and spacing according to the soil. "It is hardly necessary to say that the prime purpose of subdrainage is to insure a stable subgrade under adverse weather conditions" [1] and if this is not accomplished the money spent on subdrainage is largely wasted.

For "all-over" fields and for unpaved areas that may be used for landing, the subdrain layout will be much the same as for agricultural drainage, except that the spacing should be closer. The Corps of Engineers, War Department, give the following table [1], stating clearly it is to be used only as a rough guide and approximation:

Recomended Depths and Spacing of Subdrains for Various Soil Classes

Soil Classes	*Percentage of Soil Separates* % Sand	% Silt	% Clay	*Depth to Flow Line of Drains, in Feet*	*Distance Between Subdrains in Feet*
Sand	80-100	0-20	0-20	3-4	150-300
				2-3	100-150
Sandy Loam	50-80	0-50	0-20	3-4	100-150
				2-3	85-100
Loam	30-50	30-50	0-20	3-4	85-100
				2-3	75- 85
Silt Loam .	0-50	50-100	0-20	3-4	75- 85
				2-3	65- 75
Sandy Clay Loam ..	50-80	0-30	20-30	3-4	65- 75
				2-3	55- 65
Clay Loam	20-50	20-50	20-30	3-4	55- 65
				2-3	45- 55
Silty Clay Loam ..	0-30	50-80	20-30	3-4	45- 55
				2-3	40- 45
Sandy Clay	50-70	0-20	30-50	3-4	40- 45
				2-3	35- 40
Silty Clay	0-20	50-70	30-50	3-4	35- 40
				2-3	30- 35
Clay	0-50	0-50	30-100	3-4	30- 35
				2-3	25-30

Detail soil profiles should be prepared and permeability tests run on typical soils to supplement the above data.



Surface drainage at Chicago airport.

The layout of the subdrain system may be in accordance with any of the usual types, except that it may be influenced by local conditions. Among the more common types are: (1) the herringbone; (2) the parallel; (3) the gridiron; and (4) a layout follow-

ing the natural contours. Since an airport is normally graded to form an almost level surface, one of the first three types mentioned above will generally be used. The soil conditions and spacing of drains required will affect the type of layout in some cases.

In order to assure good drainage during intermittent freezing and thawing weather, the drainage trenches sould be backfilled with porous material, except for the top 6 ins., which should be of the general nature of the more pervious surface material in order to prevent fines from entering and clogging the drain. A drain of this design will start functioning as soon as the frost has thawed to a depth of 6 ins.

Drains are not normally required under the runways, interception of the underground flows from outside the runway ordinarily being sufficient; but in the case of very wide runways, additional subdrains may be considered. For all unpaved areas where it is desired to provide for landings, complete subdrainage should be installed.

To insure permanency of the functioning of the drainage system, all materials used in it should be of sufficient strength and permanent life, giving careful consideration to acid, alkali or any other corrosive qualities of the soil. Ordinary farm tile should not be used but all clay pipe should be A.S.T.M. standard.

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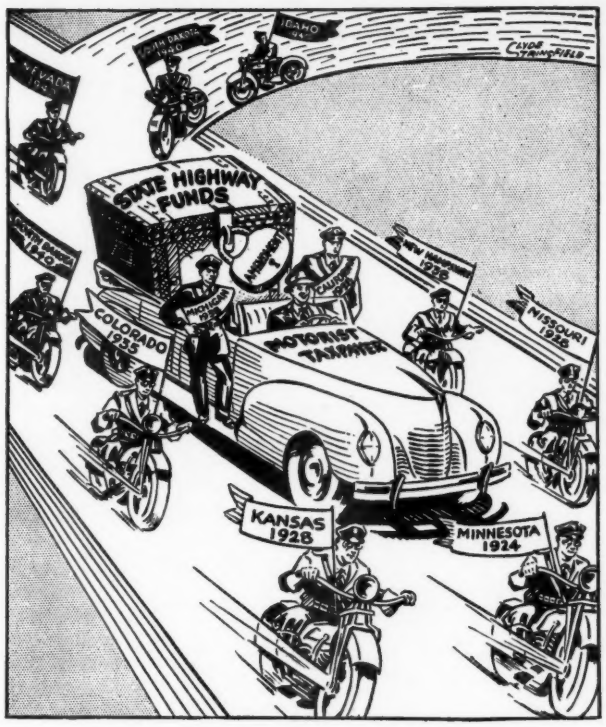
[1] Design of Airport Runways. Corps of Engineers, War Dept., Jan., 1941.
[2] A Study of Recorded Runoff from the Port of Columbus Drainage System. Unpublished thesis for the degree of Bachelor of Civil Engineering, Ohio State University, Olen C. Carter, 1936.
[3] Reports of Engineering Experiment Station, Iowa State College, and of Agricultural Experiment Station, University of Minnesota.



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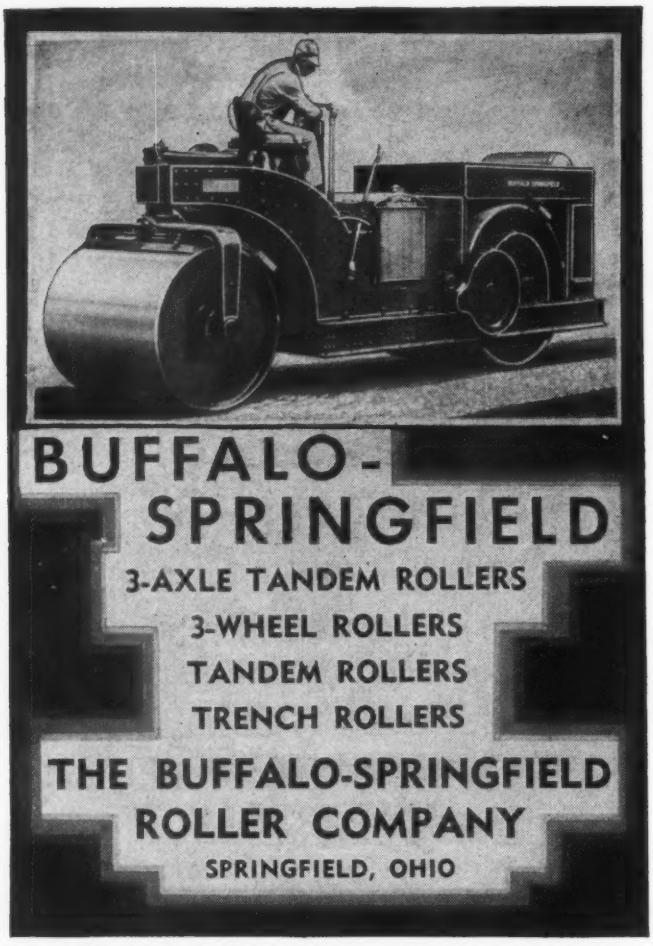

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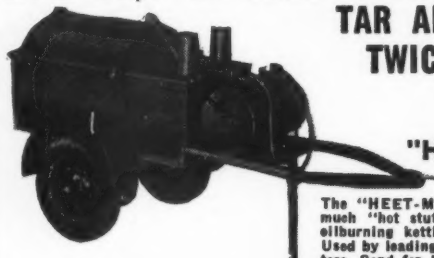

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(Continued from page 21)

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To determine the extent of loss of moisture in the section where clay was the major component of the embankments, investigations were made twenty-seven months after placement. The aggregate used for blending with clay were pea gravel and coarse sand. Nine samples showed that, in 67% of the area involved, the moisture reduction was only 1.4%; in 22% of the area, the reduction was 2.45%, and in 11% it was 3.2%.

The 1937-38 embankment experience established the fact that backfills at structures, where compaction methods were more difficult, should be studied further since it was at those points that subsidences were noted. Over the past several years, there has been a distinct improvement in structure backfill by requiring a definite soil gradation, with moisture control and a type of compaction adapted to areas inaccessible to rollers. In every instance materials were specified, which the soil survey showed to be locally available with little processing. For example, one such specification required for a bridge abutment backfill up to the old ground—a 2″ maximum size with a minimum of 70% passing ¼″, with a clay and silt content not less than 10% and not over 20%. Above the ground surface and to subgrade on the approach, the same 2″ top size was required with 55% to 75% passing a ¼″ mesh. Clay and silt of 10% minimum and 25% maximum were designated. Water content percentage was stipulated. Compaction in thin layers with a mechanical tamp with power and weight equivalent to an Ingersoll-Rand pavement breaker No. CC-45 and with a foot not in excess of 50 square inches was specified for all areas where tamping or flat rollers were not readily accessible. Pavement was immediately laid over the area affected and after 2½ years shows no subsidence.

Another specification permitted gradation minimums of 100% through a 4″; 75% through 1⅜″; 60% through ¼″ and 20% through 100-mesh. The 100-mesh requirement furnished also, in this case, adequate binder. This material was used both at the toe and back of abutments.

In our subsurface information for bridge design, we screen analyze our core borings to the 200-mesh and determine the percent of moisture. With this data at hand a descriptive report of the soil in standardized terms is prepared for the designing office. Further analysis and separation of silt and clay con-

tents are provided in those cases where advisable. Also shown on these tabulations are casing and spoon resistances in the core drilling. On one recently completed job consisting of a seven span highway structure over railroad, where 70′ open end steel shell trestle type bents were designated, the complete analysis of soil was extremely helpful in the design and in producing proper precautions in construction. The soils in some instances were from 93% to 99% passing the 270-mesh and contained 21% of moisture. Those soils averaged 63% silt and 27% clay. Every effort was made to seal out all surface moisture from the higher levels by treating the influencing area with bituminous waterproofing materials and by intercepting cross drainage where impervious layers should be located. The particular area in which these unusual precautions were taken is notorious for its unstable soils, both surface and subsurface.

In addition to observing weak spots in the road to be reconstructed, we take soil samples at such points and elsewhere not less frequently than at 1,000-foot intervals, and endeavor to locate subsurface water tables and the direction of flow. This permits the designer to provide for removing, where necessary, the capillary soils or to raise the highway profile so as to be 4 ft. above the ground water, or above the area of capillary influence when blanketed by stabilized soil or granular material; or to introduce subsurface drainage to intercept the damaging free ground water. In those cases where in reconstruction the highway profile should, but cannot, be raised and where subsurface drainage can be effectively placed, it may be advisable to install such drainage as long as a year in advance of pavement resurfacing, since drying out of the old foundation may cause subsidence as a result of reducing the moisture content. Where underdrains are surrounded and covered with porous materials, we believe that they can be made more effective for a longer period if infiltration of fine soils is prevented or at least reduced. Infiltration caused entirely by subsurface water is difficult to cope with, but surface drainage can be sealed out by providing some sort of roofing over the top of the porous trench. We insert a tar paper 8 inches below ground surface and cover with less pervious material.

In the construction of highways across muck or swamp areas we have been fortunate in that in three cases experienced in the past several years, our soil profile developed stable soils at depths to which we could successfully and completely excavate with drag line or other usual excavating equipment. In each of the cases suitable, granular materials were used for backfilling and pavements were placed thereon in the next season.

Base courses in our rigid pavements generally are provided by run of bank or graded gravels of thicknesses dependent upon the soil conditions encountered. In cut sections parallel underdrains are installed with frequent roofed weep drains connecting the gravel foundation to the underdrain in trench.

For the flexible surfaces, base courses provided are usually of one or more layers of bituminous filled stone macadams of thicknesses dependent upon the demands and superimposed over a run of bank or graded gravel if necessary or advisable.

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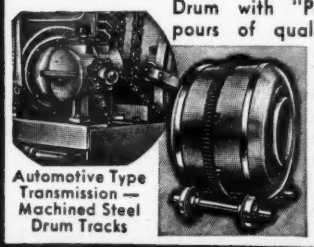

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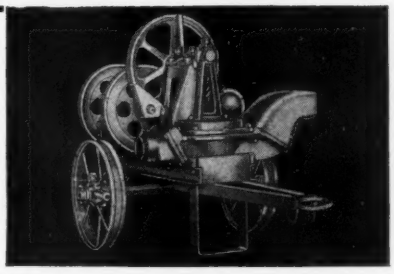

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It is advisable that subgrades be compacted with moisture contents at their proper optimums. It appears that the upper layer of the subgrade in cuts should be scarified and broken up to permit of re-compaction for further denseness under proper control, possibly by introducing a blend in the top 3 or 4 inches. The soil profiles or test pits act as a guide to indicate the proximity of inferior soils within the frost line which should be removed and replaced with materials that can be properly stabilized.

The highly expansive clays and silts requiring high water contents for proper compaction should generally be wasted and suitable materials substituted.

Where stage construction is possible and a gravel or temporary pavement is adequate for traffic for one or two seasons, there is of course the opportunity of correcting weak spots before expensive pavements are placed. More complete drainage and stabilization of large cut slopes can be visualized and accomplished. Seeding and sodding of such slopes can be more effectively accomplished.

Soil stabilization technique and mechanics are particularly advisable on jobs of heavy excavation and embankment where the final pavement is an immediate traffic requirement. Such jobs should be anticipated so as to permit of complete investigation and careful design. They require a laboratory well equipped and manned as a preliminary to construction as well as similar field equipment during construction. Materials may be non-uniform, requiring continuous field analyses to keep ahead of the contractor.

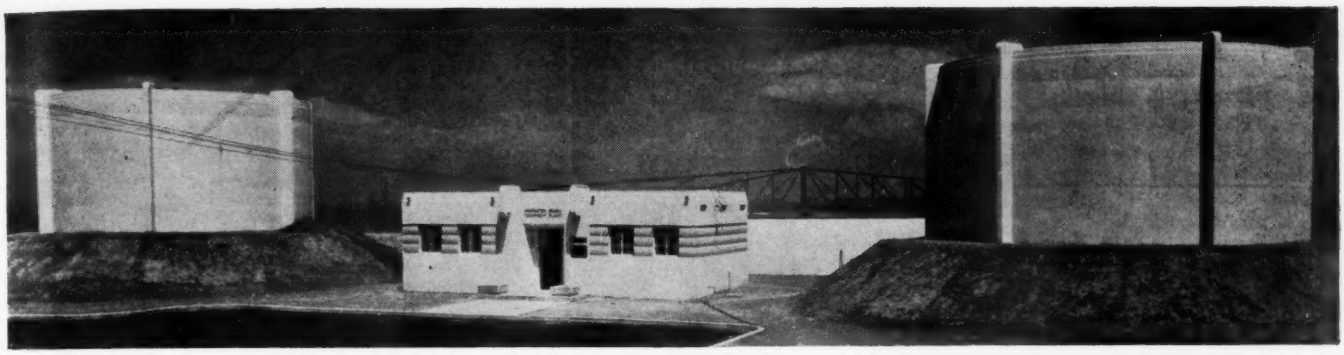
There is a place for soil science in modern highway construction. The extent of its use depends very much upon the character and extent of work. It has many applications; it is influenced by the availability of local laboratory facilities and its character and efficacy is dependent upon an engineering organization with an understanding of the principles involved. In my engineering organization approximately 10% of the personnel have studied and attended at least one session of the Bureau's soil school. We have one soils engineer with a moderately equipped district laboratory and a small mobile unit for quick determination on construction work. Sampling by auger and pits is done with maintenance labor under his direction.

This is an abstract of a paper before the 1941 meet- of the Highway Officials of the North Atlantic States.

Cost of Painting Standpipes

The Portland (Maine) Water District has, in addition to three reservoirs, thirteen standpipes, of which one is wrought iron, nine are riveted steel and three are welded steel. The standpipes are cleaned and painted every four or five years, being given two coats outside and a hot coat inside. The average cost per square foot for painting inside and out has been 3.8 cts per square foot; the cost for each tank, with its diameter and height being as follows: 36 ft. diam. by 77 ft. high, 3.15 cts.; 35 x 50 ft., 3.74 cts.; 40 x 75 ft., 3.24 cts.; 40 x 55 ft., 3.68 cts.; 15 x 50 ft., 5.47 cts.; 35 x 90 ft., 3.11 cts.; 25 x 70 ft., 3.44 cts.; 40 x 50 ft., 3.59 cts.; 30 x 25 ft., 4.8 cts. Four, built in 1938 and 1939, have not yet been repainted.

One of these standpipes is probably unique in that it burned fiercely—or rather the inside coat of bituminous paint did—while being painted in 1938. This incident was described in PUBLIC WORKS at the time.



Huntington Beach, Calif., treatment plant; Currie Engrg. Co., consulting engineers.

The Sewerage Digest

HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

Treating Steel Pickle Liquor

The steel wire plant of the Gilbert & Bennett Mfg. Co. at Georgetown, Conn., has for ten years been so treating its 58,500 gpd of waste liquors that the stream below the plant is annually stocked with trout and the effluent has a pH of 8.2 to 10.2. The sludge resulting from the lime treatment might possibly be used for fertilizer or other purposes, but to date use as a medium for refining illuminating gas seems most promising; however, research is still continuing.

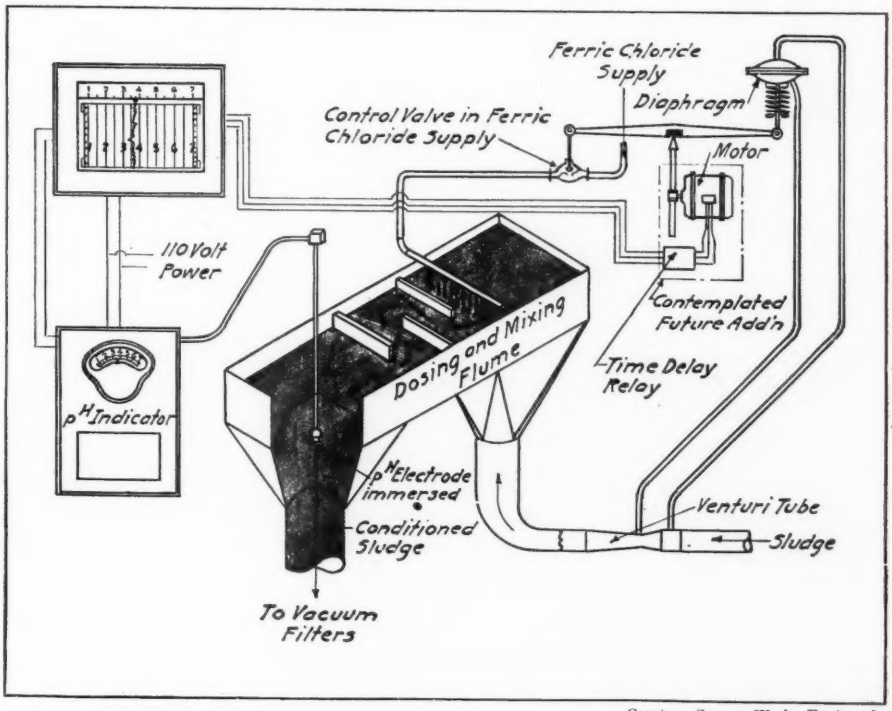
The waste liquors contain ferrous compounds, sulphuric acid and lime. They are thoroughly mixed and about 1000 lb. of hydrated lime a day is added, and passed into a settling tank. The sludge is discharged into two lagoons having a combined area of about 3 acres, surrounded with cinder dikes and the bottoms covered with the same material. The liquid soaks through the cinders and must eventually reach the river but the latter shows no evidence of it. No sludge has been removed from the lagoons until recenty.[H 16]

Automatic Recording Of Sludge pH

At Chicago's Southwest Treatment Works more than a tank car full of 45% ferric chloride, costing over $600, is used daily to condition sludge for filtration, and it seemed economical to regulate the pH closely. In a dosing flume a full strength solution of ferric chloride is added continuously, the ratio to flow of sewage being maintained by means of an Askania regulator, which ratio may be regulated from 1:150 to 1:750. The primary actuating impulse for operating the Askania unit is the differential pressure developed by a venturi tube in the sludge line (See illustration), changes in which are transmitted to a spring-loaded diaphragm, the position of which determines the position of the ferric chloride control valve. After the ferric chloride and sludge have been mixed, the sludge comes in contact with the glass electrode of a Beckman pH indicator which is continuously immersed in it. A continuous pH record is obtained on a strip chart by means of a Tagliabue Celectray potentiometer recorder controller. The pH recorder is equipped with a movable pointer having a high and low electrical contact; contact of the pointer with either of these energizes a reversible motor and a secondary impulse is periodically impressed on the Askania controller. Thus automatic compensation is made for changes in sludge concentration, ferric chloride concentration and changes in the ferric chloride demand of the sludge.[H 18]

Bulking Of Activated Sludge

As a result of studies of the role of *Sphaerotilus natans* in activated sludge bulking, Ruchhoft and Kachmar conclude that bulking is "a response of sludge organisms (zoological bacteria and probably others) to a sudden disturbance in biological equilibrium. The three primary factors involved include the sludge, food and



Courtesy Sewage Works Engineering

Diagrammatic sketch showing principles of pH automatic recorder and proportioning controls, Sanitary Dist. of Chicago, Southwest Sewage Treatment Works.

rate of oxygen supply. Variations in one or more of these factors may produce the disturbance causing bulking. This disturbance affects primarily the biophysical character of the matrix as indicated by a reduction in short time adsorption capacity and by the formation of a light non-compact floc. The disturbances does not immediately affect the oxidizing capacity of the floc. The phenomenon can therefore best be described as a biophysical response to a sudden change in biological equilibrium. The appearance of *Sphaerotilus natans* is not a primary cause of bulking. The disturbance to which the sludge floc responds to produce bulking in certain instances also produces Sphaerotilus growths. In such cases the interweaving of the *Sphaerotilus natans* filaments with the light floc accentuates the condition." In discussing this paper, Heukelekian and Ingols disagree with the statement that bulking is associated with a decrease in the adsorption power of the sludge, citing the common observation that the effluent is usually more sparkling when the sludge is in a bulky condition; also do not consider the evidence it offers as proof that *Sphaerotilus natans* is not a primary cause of bulking.[C12]

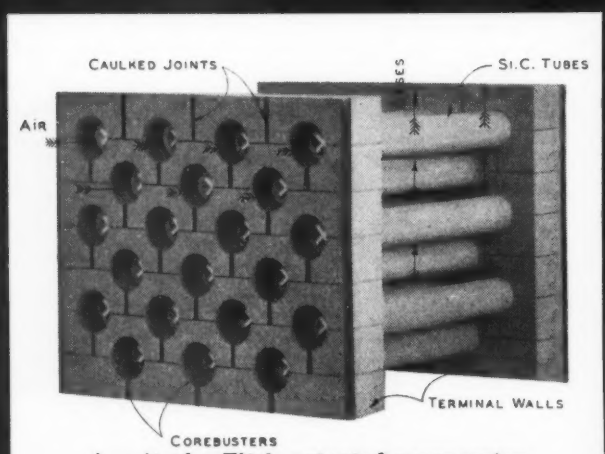
According to Heukelekian, while activated sludge is an aerobic process, passing air through an aeration tank does not necessarily insure aerobic conditions, because of low rate of solution of oxygen in sewage; passage of most of the oxygen into the air unused; the high oxygen demand of large numbers of organisms in activated sludge in the presence of food materials; and inefficiency of the spiral flow aeration system with its short circuiting and core formation. It is essential that dissolved oxygen be present at all points in the tank. The activated sludge process is suitable only for wastes in which the concentration of food material is low.

Bulking is a disease of the sludge, developed in the course of purification of sewage when environmental conditions are unfavorable but not so unfavorable as to destroy the purification mechanism and yet sufficiently so to bring a shift in the delicate biological balance. When the oxygen supply is ample in relation to the demand, zoogleal organisms thrive, *Sphaerotilus* organisms are small in number and the sludge settles rapidly. When the oxygen supply becomes inadequate, *Sphaerotilus* and other filamentous organisms get the ascendancy and the sludge becomes bulky. The failure of bulky sludge to respond quickly to a greater air supply does not disprove the contention that an adequate air supply applied at a critical period prior to the outbreak of the "disease" would have been more effective in checking and preventing bulking.

To prevent bulking, the operator should be constantly vigilant, make daily miscroscopic examinations of the sludge for filamentous organisms, and daily dissolved oxygen determinations of the aeration tank contents, and nitrate determination as an indication of adequate oxidation. If bulking threatens, the first precaution is to reduce the amount of sludge in the areation tank and the quantity of air supplied; do not allow sludge to accumulate in the settling tank and become stale; if necessary, dilute the sewage with effluent or water, or chlorinate the sludge to reduce high initial rate of oxygen demand.[C13]

Electrolysis In A Digestion Tank

The digestion tank at the Terminal Island sewage treatment plant of Los Angeles, Calif., after 14 months' operation was emptied and inspected and excessive pitting and corrosion was found on almost all the metal parts which had been in contact with the sludge, liquor and scum in the tank, some pits being 5/16 in. deep, and



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"On recommendation of the committee sent to Maryland and New Jersey last week to inspect incinerators, the council awarded the Nichols Engineering and Research Corporation of New York City the contract for furnishing and installing incinerator equipment at a cost of $68,750.

The committee reported that incinerator equipment costing about $50,000 less, on which bids were received last week, was unsatisfactory. Members explained the equipment would burn garbage alone and garbage and sewer sludge combined, but would not burn sewer sludge alone, as will be necessary in Rock Island, without the use of considerable additional fuel.

Committee members, in explaining their recommendation for the purchase of the more expensive incinerator equipment, said the cheaper equipment failed to burn the sludge and garbage thoroughly and that working conditions in plants where such equipment was in operation were far from proper."

Quoted from The Rock Island Argus, 1-23-40

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several ¾ in. manhole steps were almost eaten through. The sewage contained much fish cannery waste, including salt water, and high chloride content due thereto seemed to be the only characteristic by which it differed from normal sludges elsewhere, reaching as high as 5,000 ppm in the sludge. After considering several possible causes it was concluded that the trouble was due to electrolytic action and that the tank was acting as a wet battery and producing electricity, with the affected metal parts acting as anodes. It was found that the metal objects that were corroded were in good contact with the reinforcing steel in the tank walls.

An effort has been made to prevent future corrosion by cathodic protection. A rectifier connected to the lighting circuit furnishes direct current, which passes to anode plates hung in the sludge, thence through the sludge to the hot water coils, stirring mechanism and other metal parts to be protected, and from these by individual return wires to the bus plate and back to the rectifier. The total power used is about that consumed by a medium size electric light. It is believed that this is effective, although the tank has not been emptied for inspection. Cases of electrolysis caused by submersion of metal in two different solutions, such as water and septic sewage, were cited by Richard Pomeroy; as a demonstration a small motor was run by the current generated by immersing two copper plates in water and sewage respectively.[C15]

Mechanical Equipment

Screens. Since any screen cleaner must employ some wiping or rubbing action, excessive wear takes place with inherently high maintenance costs. Experience indicates that openings should be no smaller than is necessary to protect the equipment that follows; cleaners may become inoperative and therefore all screens should be designed to withstand the full head to which they might be submitted if they became, in effect, a dam; all working parts of the cleaning mechanism should be able to withstand the full stresses that can be applied to it.

Tanks. Sludge removal equipment is now best made with individual drives on each mechanism, with use of reliable overload protection on motors and with all parts designed to withstand the full motor torque.

Pumps. High efficiency of sewage pumps, within reasonable limits, is a matter of small moment; the important requirements are the average efficiency over a period of years, and freedom from attention and repairs. The most difficult pumping job is pumping preliminary tank settlings or those from a concentration tank; no available pump can do this without screening, the degree of screening necessary depending largely on the size of the pumping unit—the larger the pump the coarser the screen can be. Ordinary pumps cannot withstand the severe operating conditions of sewage pumping. On parts of the casing and impeller receiving excessive wear a hardened surface justifies the cost by increasing the life. For wearing rings the Chicago Sanitary District finds the use of a hard, abrasion-resistant material the most satisfactory. Rotating rings obtained by the nitridation process are excellent but at present impracticable. All pumps at the North Side works are now equipped with wearing rings of cast iron, the wearing surface of which has been sprayed to a depth of approximately 1/16 in. with a high chrome, high carbon steel which air hardens to a Brinnel hardness of over 400.

Vacuum filters. Filtering cloths is the most important item of maintenance. Cloths of all virgin wool twill weave, 12 oz. per sq. yd. have been

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"After 17 years operating, maintaining and developing mechanical equipment in sewage treatment works, I feel I may safely predict that we will see even more complex and automatic mechanical equipment in future works."[C18]

Recent Trade Waste Methods

Methods for treating industrial waste must require a minimum of technical attention, be inexpensive in construction, have high efficiency, and be capable of withstanding the shocks of widely varying volumes and strength of waste. During the past year a paper board mill in Michigan has installed a plant consisting of alum machines, flash mixers, coagulation tanks and settling tanks. A recent beet sugar plant consists of standard commercial screens, grit removers, and equipment for coagulation and sedimentation. For secondary treatment, one of the outstanding processes is the bio-filtration, another is the biochemical method developed by Guggenheim, which combines the manipulation of activated sludge with that of chemical flocculation. From a storage or equalizing tank, in which air is applied to keep the wastes from becoming septic and prevent sedimentation, the liquid waste passes to an areation tank, receiving lime and ferric chloride on the way. After aeration it passes to a settling tank, a part of the sludge from this being returned to the chemical mixing unit. This has been successful with milk and cannery and even very strong cheese wastes. It has a much shorter aeration period than activated sludge, the sludge never bulks, it is much more efficient in B.O.D. removal than chemical treatment or than activated sludge using the same aeration period, is adaptable to wastes up to 3,000 ppm B.O.D., and by recirculation can be made to produce extremely low effluent B.O.D. values.[C21]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n,* note or short article; *p.* paper before a society (complete or abstract); *t,* technical article.

C *Sewage Works Journal*
January

12. *t.* The Role of Sphaerotilus Natans in Activated Sludge Bulking. By C. C. Ruchhoft and J. F. Kachmar. Pp. 3-38.
13. *t.* Activated Sluge Bulking. By H. Heukelekian. Pp. 39-42.
14. *t.* Graphical Analysis of the Oxygen Sag. By W. E. Howland and F. Farr. Pp. 43-47.
15. Electrolysis at Terminal Island. By G. A. Parkes. Pp. 48-60.
16. *t.* Self-Purification of Sewage. By H. Heukelekian. Pp. 61-65.
17. Sewage Flows and Composition Affecting Treatment. By A. M. Rawn. Pp. 66-72.
18. Mechanical Equipment in Sewage Treatment. By L. M. Johnson. Pp. 73-88.
19. Licensing of Sewage Plant Operators. By C. C. Agar. Pp. 89-100.
20. Progress in the Conditioning of Sewage Sludge for Dewatering. By H. A. Faber. Pp. 101-104.
21. Recent Trade Waste Disposal Methods. By E. F. Eldridge. Pp. 105-114.
22. Experimental Treatment of Citrus Cannery Effluent in Florida. By H. W. Loesecke, G. N. Pulley, A. J. Nolte and H. E. Goresline. Pp. 115-131.
23. Operation of the Massillon, O., Sewage Treatment Plant for the Year 1939. By R. F. Snyder. Pp. 132-140.
24. Salient Features of the Sewage Treatment Works at Lima, O. By E. E. Smith. Pp. 140-142.
25. Under Your Glass Table Top. By W. D. Hatfield. Pp. 142-145.
26. The Comminution of Sewage Solids. By P. F. Morgan. Pp. 145-150.

D *The Surveyor*
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5. Sewerage and Sewage Disposal Engineering in 1940. Pp. 65-68.
6. Refuse Collection and Disposal in 1940. Pp. 68-70.

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7. *p.* Municipal Manufacture of Humus from Habitation Wastes. By F. C. Temple. Pp. 125-127.

E *Engineering News-Record*
March 13

7. Grease From Sewage Helps Great Britain. By H. W. Smith. Pp. 83-85.

H *Sewage Works Engineering*
March

16. Steel Pickle Liquor Treated With Lime. By W. J. Snow. Pp. 158-162.
17. Sewage Treatment Abroad Affected by

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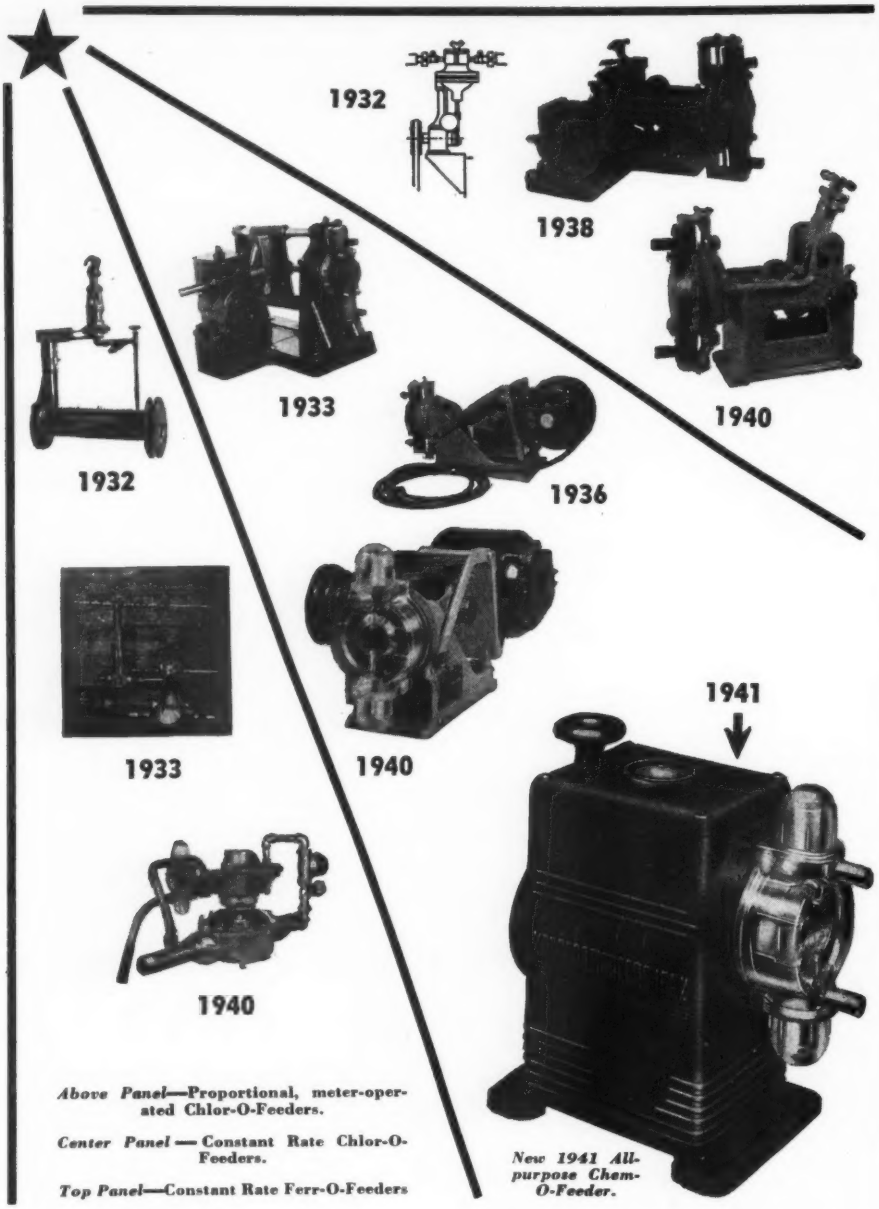

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War and Economic Conditions. By G. Ornstein. Pp. 163-166.

18. Automatic pH Recording Controls Sludge Filtration. By A. J. Beck and L. M. Johnson. Pp. 167-169.
19. Green Bay Gas Engines Show $10,000 Profit. P. 169.
20. Industry Abates Stream Pollution. By H. H. Black and C. W. Klassen. Pp. 170-174.
21. Refuse Incinerator of Herkimer, N. Y. By H. W. Taylor. Pp. 175-176.

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8. Imhoff Tanks and Filters Handling Strong Sewage. Pp. 40-42.
9. Texas Sewage Plant Has Stage Aeration. By H. B. Gieb. Pp. 43-44.

P *Public Works*
March

12. Sewage Treatment for Airports. Pp. 11-13, 40-45.
13. *c.* Excavating Rock in Sewer Trenches. P. 18.
14. Treating Milk Wastes by Two-Stage Filtration. By E. F. Wittmer. Pp. 19-20, 37.
15. *p.* Sewer Maintenance in California. Pp. 30, 32.

Revocable Permission to Lay Sewer and Water Mains

Denying an injunction compelling a city to remove a water main from complainant's premises or to restrain the city from using the water main without due compensation to complainant and to remove or discontinue the use of sewer and drain pipes, the Maryland Court of Appeals held (Mayor, etc. of Baltimore v. Brack, 3 Atl. 2d. 471) that a municipality is charged with the all-important public service of supplying sewerage, drainage and water facilities to its inhabitants, and where the effect of an injunction will be to endanger the public health and security until the municipality is given the opportunity to abate the injurious condition. But where the city merely had permission from a former landowner to lay sewers and water mains, and a subsequent purchaser of the land revoked the city's license, the city was held liable to such purchaser for the reasonable compensation for use of the easement pending either the removal of the utilities from the land or the city's acquisition of the easement by condemnation.

Eminent Domain Rule in Sewer Excavation

The Washington Supreme Court holds (Muskatell v. Queen City Construction Co., 100 P. 2d 380) that the rule in that state is that where a city, acting within its general powers contracts for improvement upon a street, and the work is done by a contractor in accordance with the plans and specifications furnished by the city, he is the agent of the city and is not liable in damages in the absence of negligence in the performance of the work. The court applied this rule to the case of a contractor employed by a city to construct a trunk sewer, although the city had not brought condemnation proceedings. There was no way of knowing, until after the trench was dug, that water and sand would escape from under plaintiff's adjacent building and find its way into the trench, and the contractor was held not liable for damages resulting from subsidence of the building.

Head house of Sacramento, Calif., water supply.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

Financing Main Extensions

For financing extensions to its distribution system, Los Angeles, Calif., has obtained funds by taxation (municipal bonds), water rates, and contributions. The last are in the form of grants from governmental agencies, formation of districts, acreage supply charges, service and meter installation charges, and frontage charges. Frontage charges are made for all extensions, at the rate of 80 cts. per front foot of the property to be served if the extension does not exceed 200 ft. from the existing main to such property; but if the extension exceeds 200 ft., a deposit of $1.60 per lineal foot is required; this, minus 80 cts. per front foot of property served, to be refunded when street frontage charges have been collected from other consumers using this extension. For new subdivisions the subdivider must pay $1.60 per lineal foot for pipe in street plus regular charge for fire hydrants and service connections. Where mains larger than 6″ are required for industrial tracts, the entire cost is charged.[A23*]

Hardy Cross Method Of Distribution System Analysis

There are three general scientific methods for analyzing flow in networks of pipe—the Freeman graphical method; the electrical network analyzer of Camp and Hazen; and the Hardy Cross method. The first involves so much labor that it is not widely used; the cost of equipment for the second prevents its wide adoption. The Hardy Cross method permits solution of a complex network in a short time with use of pencil, paper and slide rule. The authors used this method to analyze distribution systems of two towns, one of 2,000 population, the other 15,000. The latter, involving a network of 62 loops of 4″ to 16″ pipe, was completely analyzed in 30 man-hours; the smaller one in 13 man-hours. The time could be reduced considerably by eliminating numerous pipes that have little bearing on the final pressures.[A24]

Prof. Doland considers the use of percentage of flow superior to that of flow in terms of gpm in using the Hardy Cross method; and that balancing of circuits can be accomplished more quickly and satisfactorily by substituting 2 for the exponent 1.85, making the equation $h=rQ^2$; also that it is more practicable to plot pressure contours in terms of per cent of total available head, based on per cent of total flow, than in terms of per cent of feet of head for an assumed fixed demand in gallons per minute.[A25*]

* See Bibliography in March issue.

Motion Pictures for Water Works Publicity

The motion picture is an excellent vehicle for carrying the water works message to the public. To be effective it should be suitable for audiences of 10 to 200, indicating a film size of 16mm.; should be 20 to 30 min. long—400 to 600 ft. of film; should be interesting to persons of all ages — generally using sound, although this may be the spoken voice of the exhibitor. If home-produced, it should compare favorably with a professional job. A scenario or story outline should first be prepared.

The equipment required are a camera and tripod, light meter, lights for interior views, and film. The last will cost about $50 for a 20 or 30 minute picture.[A21*]

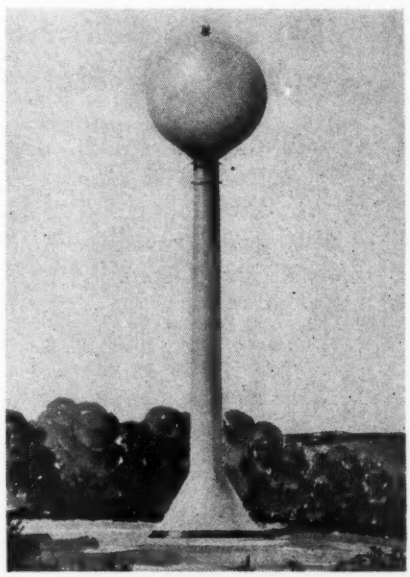
Watersphere Tank For Madison, Wis.

Madison has contracted for a 100,000 gal. steel tank in the form of a sphere supported 100 ft. above the ground by a single steel column. The sphere is 30 ft. in diameter; the plates used vary ¾ in. to ½ in. in the bottom half and the upper half is of ¼ in. plates. The base of the column is a tunicated cone 16 ft. high, 26 ft. diameter at the bottom and 8 ft. at the top, on which rests the column 80 ft. high and tapering from 8 ft. diameter at the bottom to 6 ft. at the top. The structure was designed to be safe with a wind velocity of 100 miles per hour. The tank will be equipped with aeronautical lights, a cathodic rust prevention unit; and an automatic cone valve to control the height of water in the tank, located in the base of the tower and thus saving the cost of a special pit.

The cost is about 6% more than that of the best designed conventional tank, but this was considered warranted because it was located in a select residential district and would be unique and pleasing to the eye, cost less to repaint, and there are no supporting legs up which youngsters can climb with danger of falling off.[G16]

Repairing Water Meters

Dallas, Texas, instead of replacing worn parts with new, often finds it economical to build up or bush a worn part and machine it, being careful to use corrosion and wear-resistant material. For this work, their chief machine tools



Courtesy "Water Works & Sewerage"
Madison's "Watersphere."

are a lathe and drill press, both quite small and of very high speed, supplemented with a variety of dies, presses and jigs. Also necessary are equipment for brazing and soldering, hand tools etc. in a large, well-lighted shop.[X 11*]

Sterilizing New Mains

Houston, Texas, sterilizes every new main before placing it in service. Each length of pipe, after it has been placed in the trench, is swabbed clean, and a plug is placed each night in the end of the line under construction. Yarning material is laboratory tested for phenol and bacteria; sterilizing in the field with concentrated chlorine solution is highly unsatsfactory. For sterilizing the mains they use a Ford V-8 truck with power take-off connected to a 7.5 KVA 200-volt generator, running a 3 hp. motor direct connected to a 2-stage, high head, low capacity pump that can give any pressure up to 250 lb. per sq. in. for injecting chlorine into the main under pressure. A W&T manual, vacuum, solution-feed type chlorinator controls the chlorine dose, which is fed through a 1" corporation cock. The control valve is opened 3 or 4 turns (all other valves and fire hydrants having been opened wide) and chlorine is fed at rate of 100 lb. per 24 hr. When a chlorine residual of 50 to 100 ppm is found at all hydrants the control valve is opened wider and main flushed clean. Then chlorine supply is closed and line flushed free of chlorine.[X 13*]

* See Bibliography in March issue.

Underground Water In Texas

The future development of Texas will be limited by its water supply. The state has only 4% or 5% as much surface supply in proportion to its area as the country from Illinois to New England. Her underground supplies are being steadily, and in many regions permanently, depleted. The gradual exhaustion in one large region will be particularly serious because practically no surface supplies exist there.[X 19*]

Cross-Connections and Inter-Connections

The March issue of the Journal of the American Water Works Association is devoted to two monographs on Cross-Connections, Inter-Connections and Back-Flow Protection; one, by R. F. Goudey, dealing with the practical aspects, the other, by Robert E. Moore, Jr., with the legal aspects. These two papers, 103 pages and 114 pages long, respectively, cover the subject quite completely. The purpose of the former is the development of a broader view of cross-connections and inter-connections and classification of their types; determination of the inherent causes of back-flow and back-siphonage; summation of the best information gleaned from over 150 questionnaires submitted by state health departments and by all of the largest cities in the United States, in the matter of appropriate laws, codes, ordinances, and regulations; comparison of various mechanical devices and plans of protection; and recommendations of a consistent program covering the entire field of cross-connections and inter-connections.

The second paper considers the legal problems of sanitary control under the general heads of "Legal Theories and Public Policy," "Statutory and Common Law Liabilities," "Decisions," "Illustrative Statutory Provisions" and quotes rules, regulations and proposed ordinances.[A38 & 39]

Model Of Filter Plant

A working model of a rapid filter plant is shown in the office of the Denver Water Dept. It is mounted on a base 2 x 3 ft. The water tank is an oil container 7" x 9" on top of a 45" tower made of ½" angle iron. An areation, coagulation and sedimentation unit is made from a 7 x 10 x 5 in. aquarium, and two others of the same size are made into a filter unit and a filtered water reservoir; all arranged in a stair step pattern so as to operate by gravity. Water is pumped into the tank by means of two electric pumps of 1.1 gpm combined capacity, operated by a 6-volt storage battery. Areation is by means of spraying from a ¾" brass pipe and twelve 3/16" laterals drilled with 1/32" holes. Chemicals are caused to mix with the water by 7 baffles. The underdrains of the filter are pipes of the same size used in the aerator, and are covered with gravel, ¼" depth of sand and 1¼" depth of anthracite, this being the material used in the city's largest filter plant. The pipes connecting the units are ½" pure gum, heavy-wall rubber tubing.[F32]

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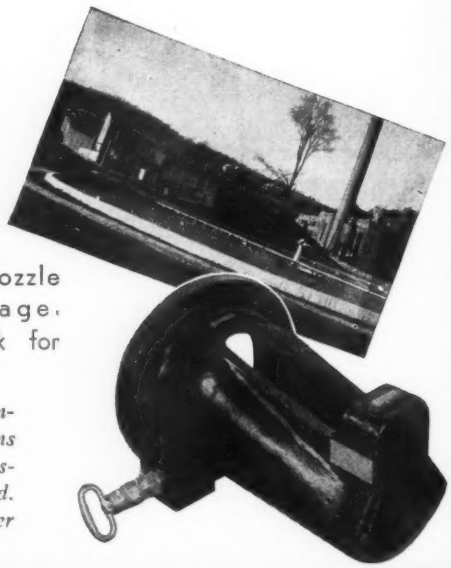

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Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p.* paper before a society (complete or abstract); *t*, technical article.

A *Journal, American Water Works Association*
March

38. Practical Aspects of Cross-Connection, Inter-Connection and Back-Flow Protection. By R. F. Goudey. Pp. 391-494.
39. Legal Aspects of Cross-Connection, Inter-Connection and Back-Flow Protection. By R. E. Moore, Jr. Pp. 495-608.

D *The Surveyor*
January 31

3. Water Supply Engineering in 1940. Pp. 63-65.
4. Developments in Canadian Waterworks Practice, 1850-1940. Pp. 81-83.

E *Engineering News-Record*
February 27

6. *t.* Balancing Head Losses in a Pipe Network. By W. E. Howland and F. Farr, Jr. Pp. 50-51.

March 13

7. Prestressed Concrete Water Tanks. Pp. 91-93.

F *Water Works Engineering*
February 26

25. Filter Plant Operating Results at Wheeling, W. Va. By N. N. Wolpert. Pp. 228-231.
26. Experiences in Pumping Water. By H. W. Fitzgerald. Pp. 232-235.

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27. Difficult Pipe-Laying Conditions. Pp. 238-239, 253.
28. Changes to Water Supply System at Cornwall, N. Y. By H. W. Taylor. Pp. 245, 255.

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29. When Bombs Fell on Barcelona. By R. Perera. Pp. 282-286.
30. Bombs Explode in England But Water Service Continues. Pp. 289; 310.
31. *c.* Laying Pipe Under Railroad Tracks. Pp. 294-295.
32. Denver Constructs Model of Water Filtration System. By G. J. Turre. Pp. 298-299.

G *Water Works & Sewerage*
March

14. Watertightening A Concrete Reservoir Lining. By D. R. Taylor. Pp. 93-96.
15. *n.* "Blacking Out" Algae. By N. T. Bailey. P. 96.
16. Madison's New "Watersphere." By L. A. Smith. Pp. 97-98.
17. A Depth Sampler. By R. D. Nichols. P. 124.
18. American Water Softening Plants of Especial Interest. By L. J. Alexander. Pp. 125-131.
19. Anhydrous Ammonia: Its Storage, Feeding and Safe Handling. By R. J. Quinn and R. L. Carr. Pp. 132-136.
20. What Constitutes Warranty of Water on Part of Well Driller. By L. Childs. P. 139.

J *American City*
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8. Water Works of Fairmont, W. Va. By T. R. Kendall. Pp. 38-39, 79.
9. Anniston, Ala., Expands Water Works to Supply Ft. McClellan. Pp. 54-55.

L *Civil Engineering*
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1. Bacterial Contamination Improbable as an Implement of War. By C. G. Flebus. P. 147.

M *Water & Sewage (Canadian Engineer)*
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11. West Lorne Water Supply. By M. T. Gray. Pp. 11-15, 34.
12. Water Service Under Aerial Bombing. Pp. 18-19, 46.

P *Public Works*
March

15. Larchmont, N. Y., Remodels Rapid Sand Filters by Installing Porous Plate Bottoms. By H. T. Hotchkiss. Pp. 16-18.
16. Development of De Kalb's Water Works. By F. E. Peterson. Pp. 23-24.
17. Loss of Water Main Capacity Through Deposits. Pp. 34-35.
18. *n.* Automatic Control for Water Works. P. 35.

V *Journal, Maine Water Utilities Ass'n*
March

2. New Customers' Ledgers and Billing System of the Portland Water Districts. By J. A. Jackson. Pp. 28-31.
3. Standpipes and Reservoirs of Portland Water Dist. By E. O. Boothby. Pp. 31-40.
4. Preheating Water by Electricity to Prevent Submarine Mains Freezing. By H. Burgi. Pp. 42-49.
5. Cash and Control Methods. By E. M. Shapiro. Pp. 50-52.
6. Lining Water Mains in Place with Cement Mortar. By B. Harkness. Pp. 52-55.

Keeping Up With New Equipment

A New Copper Sulphate Spreader

Utility Fan Corporation, Los Angeles, Calif.

After exhaustive tests, the Los Angeles Department of Water and Power has standardized on copper sulphate distributors manufactured by the Utility Fan Corporation of Los Angeles.

It is claimed that this distributor evenly spreads the dry copper sulphate used for treatment of algae in reservoirs and lakes.

The Utility sulphur spreader is operated from any type of motor or rowboat. One man keeps the hopper loaded and regulates the rate of feed and the angle of the spout for even distribution. The hopper is adjustable to wind velocity and can be used in winds up to thirty miles an hour. The rate of flow is easily varied according to wind conditions, the speed of the boat and the amount to be spread.

The Utility distributor includes a gasoline motor driving the exhauster-type blower, and a copper sulphate container. The container has a gear reduction unit that drives the feeder at a uniform, predetermined speed. The openings are adjustable for the rate of flow desired. Overall dimensions are 46½" x 25" x 32" high, not including the nozzle.

Utility Distributor spreading copper sulphate.

Two-Time Treatment of Foot-Baths and Swim-Pools

The Foot-Bath is the weak point in the disease-defense system of today's swimming pools. The batch type Foot-Bath (non-circulating) is the pet peeve of most swim-pool operators. Athlete's Foot and fungus afflictions are combatted by present Foot-Bath methods only by the operator's ever-watchful, laborious drudgery.

The batch type Foot-Bath starts out fine, but passing pairs of feet "run down" the killing power of the Foot-Bath fluid. As more swimmers enter, the Foot-Bath solution becomes less able to cope with Athlete's Foot or other fungicidal infections.

The batch soon is "spent," and the pool operator has a dirty clean-up job to be done.

The ideal Foot-Bath safeguard is not a batch. It should be a continuous, changing stream of high-strength chlorine solution or fungicide flowing by so that no foot and no pollution stays in the cleanup fluid. New feet should call for new chemical. Fresh, clean, full-strength solution should greet each foot in passing.

The water passing through the Foot-Bath should be Treated-in-Transit. For economy's sake, the chlorine used in the Foot-Bath should be reclaimed for further use instead of thrown away and wasted, as at present.

One new system, "Two-Time" Treatment, for swim-pool sterilization and for foot-bath control has been developed to handle automatically the whole disease-defense system of modern swimming pools.

"Two-Time" Treatment is low in equipment cost, avoids waste of chemicals, is easy to install, can be adapted to your pool (whether your system now includes gas chlorinators, hypo-chlorinators, or any make of sterilizing equipment). "Two-Time" Treatment does not interfere with your present pool water purification system.

It simply protects that purification system from being defeated through faulty foot-bath equipment or operation.

This method joins the water purification system with the foot-bath equipment, and makes both continuous, in step with the main water recirculating system of the pool.

Write %Proportioneers%, 9 Codding St., Providence, R. I., for full information and costs for licenses, equipment and complete service.

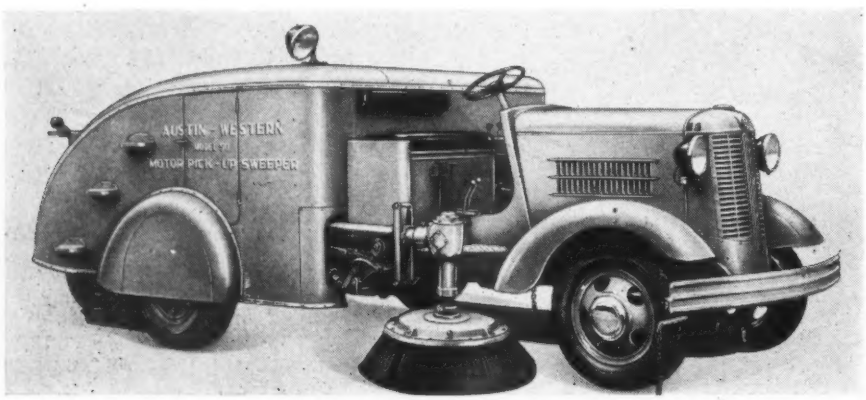
New Model Sweeper

Austin-Western Road Machinery Co., Aurora, Ill.

Trim, stream-lined, easier to handle and more efficient is how the manufacturers describe their new 2½-cu. yd. capacity, Model 50 Sweeper that sweeps a path 9 ft. wide. With better appearance, they point out, has also come improvements in cleaner sweeping, visibility, accessibility, and ease of control.

Both of the brooms and the self-cleaning, beltless elevator are independently raised and lowered by hydraulic power, simply by shifting small convenient levers within easy reach of the operator; this saves time and effort. . . . Hydraulic mechanism does not force brooms against pavement; through an auxiliary mechanical arrangement, they are made to hug pavement without "dancing," still they can rise or fall when broad, irregular surface sections are encountered. Brooms have two speeds—one for ordinary and one for hard sweeping conditions.

A four-wheel, reinforced chassis, using solid axles, gives sweeper a truck-like stability and serves to maintain a



Austin-Western Model 50 Sweeper.

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more accurate alignment of all working parts.

On the Model 50, the headlights have been moved forward from the dash to the radiator, both to further improve general visibility and also to reduce shadows during night operation. All wheels have been equipped with mud guards; booster brakes furnish additional safety; steering is easier; extra foot room and a higher floor plate add to operator's comfort; newly designed bumper gives more clearance when passing parked cars and doors provide easy accessibility for servicing and inspection. Water tank, filling hose, dirt hopper, chains and sprockets are completely enclosed. To protect operator against the elements, a fully enclosed cab can be furnished.

Pittsburgh Equitable Meter Company Announces the National Meter Division

Acquires the Organization, Good Will and Assets of the National Meter Company.

Believing that the interests of the water works trade would be more adequately served by having one company making a complete line of all types and sizes of meters, the Directors of the Pittsburgh Equitable Meter Company of Pittsburgh, Pa., have purchased the assets of National Meter Company of Brooklyn, N. Y., thereby bringing together, under one management, the facilities of two of the country's oldest meter manufacturers. The National Meter plant will be operated as a division of the Pittsburgh Equitable Meter Company. This action was ratified by the stockholders of the National Meter Company and the deal closed at a meeting of the principals held on March 17.

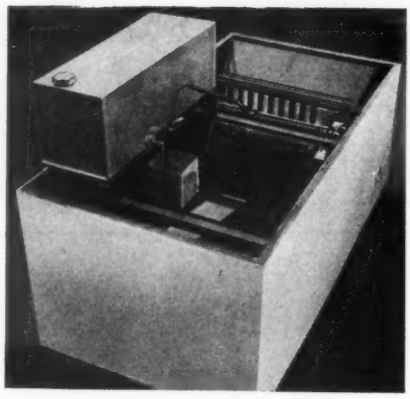
Both President W. F. Rockwell of the Pittsburgh Company, and President N. J. Kenny of National, have emphasized the completeness of the line of meters which this purchase makes possible. Buyers can select from the nine different types made by both companies. These include flat and conical nutating disc; oscillating, reciprocating and rotary piston; screw-propulsion; current and compound types. Every commercially manufactured type of liquid meter is now represented in the complete Pittsburgh-National line.

Prompt deliveries of both new meters and parts for any of the existing types can be obtained from Pittsburgh Equitable or its National Division.

No change is contemplated in the personnel. The same salesmen will continue to contact their customers in their respective territories.

The National Meter Company was founded in 1870 by John C. Kelley, known as the father of the water meter industry. Associated with Mr. Kelley from the beginning was Dr. Lewis H. Nash, the noted inventor, to whom were granted ninety-two patents on water meters.

The Pittsburgh Equitable Meter Company was originally founded as the Pittsburgh Meter Company in 1887 by the inventive genius, the late George Westinghouse. During these many years of successful operation there have been developed such well known meters as the Arctic, Tropic, Keystone, Eureka and Imo.



Furby's Liquid Proportioner.

A New Liquid Proportioner

Dr. Robert L. Furby's Liquid Proportioner Co., 1015 Bedell Bldg., Portland, Oregon

Dr. Robert L. Furby's Automatic Liquid Proportioner was first patented for use in Federal C.C.C. camps. Operated solely by gravity flow of the water to be chlorinated and having only one moving part, it is claimed to offer simplicity of operation and a minimum of supervision or attention; exact and easily adaptable to a wide range of uses; and ease of set-up. Loaded on a truck it can be easily moved about to serve in field or camp activities. It is especially adaptable for use in smaller municipalities, industries, industrial camp operations, housing projects, recreational areas and hotels, swimming pools, cantonments, airports or with an army on the march.

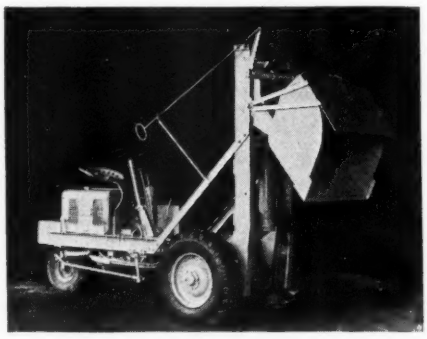
It is stated that this device is a simple unit consisting of an iron tank housing a triangular tilt bucket of like material, suspended from a steel shaft set in special bearings on a flange on the tank top edge. The tilt bucket which is triangular shovel shaped is suspended on its shaft which is perfectly balanced to receive and hold a certain inflow of water. Upon receipt of this stated inflow of water it automatically tilts discharging the chlorinated content into the main tank. This motion of tilting to discharge the chlorinated water from the tilt tank automatically operates a dipper to take chlorine solution of pre-determined strength from a stainless steel reservoir. The dipper taking the needed amount of chlorine solution as the tilt bucket dips down to discharge it's contents, automatically spills such chlorine into the bucket as it rights itself to level position. The constant flow of water filling the tilt bucket from a pipe line directly above its deep end diffuses the chlorine solution deposited by the dipper by constant agitation. This agitation provides more than ample aeration to effectively and evenly distribute chlorine solution eliminating unequal or spotted mixing.

A Small Power Shovel

Clark Equipment Co., Battle Creek, Mich.

A new material handling machine called the Clark Power Shovel is said to reduce the cost of handling loose materials and has particularly important applications in snow removal.

Working in conjunction with plows, the shovel picks up piled snow and loads it into trucks rapidly and economically.



Clark Power Shovel.

Built on a three-wheeled chassis, rear wheel steer, it is powered with a 4-cyl. Continental motor and is capable of 24-hr. continuous operation. The heavy steel scoop picks its load of loose or semi-hard material from the pile without ramming it.

The machine carries the load of 1500 lbs., bulking as much as 18 cu. ft., at from 3½ to 11 m.p.h., elevates it in less than 10 sec., dumps it into carts, trucks or bins. One model has 45 in. underclearance when dumped, another 65 in. Driver controls all operations without dismounting.

Standard equipment includes self-starter, generator and battery. Special equipment includes lights and a hopper lid that opens and closes automatically as driver picks up and dumps load. The shovel is made by Clark Tructractor Division of Clark Equipment Co., Battle Creek, Mich.

New Snow Plow Catalog

Carl H. Frink, Manufacturer, Clayton, N. Y., whose business is confined exclusively to the manufacture of snow plows, has just issued a handsome catalog. It describes and illustrates plows adapted for clearing highways and streets of snow quickly and efficiently under all circumstances. Those responsible for keeping highways open and safe should have a copy of this complete catalog. Mr. Frink will be glad to supply them.

$30,000 Worth of Pipe Line Carrying Capacity for $10,000!!!

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New York to Florida in six hours!

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You can clean up an old line and more than restore its original carrying capacity—as good as new—*for approximately 1/3 the cost of a new main.*

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- ***one continuous pipe line***
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- ***no more clogged pipe***
- ***increased the carrying capacity beyond that of a new line***
- ***reduced pumping costs in many instances as much as 50%***

The process has been under research and development to the point where it is now accepted by—leading engineers—leading editors—leading authorities in the field of water works practice.

"You can get the good things first from Activated Alum Corporation"

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Recent work at Charleston, South Carolina—West Palm Beach, Florida—Falmouth, Massachusetts—Shamokin, Pennsylvania, has convinced investigators this is the coming trend in restoration of a distribution system—without laying new mains.

This development is a process of the United Kingdom—recent U. S. Patents recently granted (owner of U. S. patents—Tate Pipe Linings, Inc., Andover, Mass.). There are Tate companies operating in London, England—Kulti, India—Sydney, Australia—Auckland, New Zealand—Salt River, Cape South Africa.

●

THINK! For a $10,000 appropriation, you can get $30,000 worth of pipe line carrying capacity by this Tate process of cleaning and lining cast iron water mains in position.

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Please send me your booklet telling the whole story of the Tate process, inside and out—with illustrations and descriptions of all procedures. No obligation to me.

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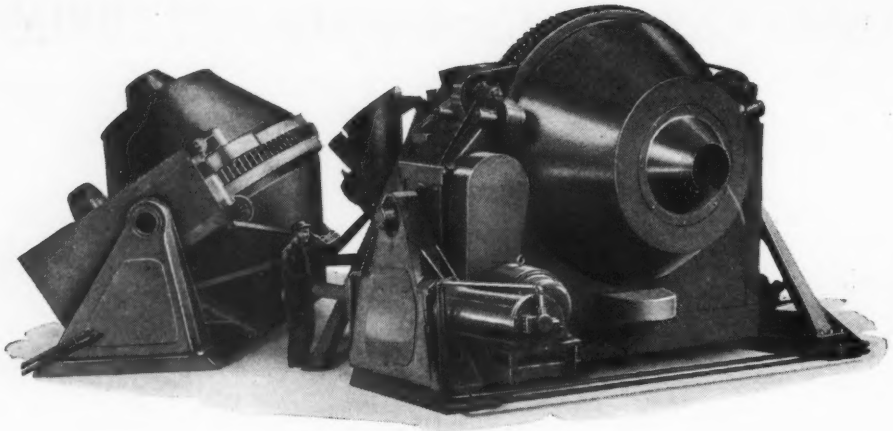


Smith Tilting mixer.

Smith Comes Out With New Improved Tilting Mixers

The T. L. Smith Company, Milwaukee, Wis., has recently added a number of refinements to its line of big tilting mixers. While the basic design remains essentially the same as the original Smith Mixer built in 1900, the modern improvements are said to result in even greater speed and efficiency.

The machines can be equipped for either front end or rear end charging to accommodate the particular plant setup. The feed chute automatically swings out of the way while the drum is being tilted. The drum ring gear and pinion, both with machine cut teeth, are made of high carbon steel. Other new features claimed for the new Smith Tilters include: all-welded, steel tilting frame —machine cut reduction gears, running in oil — multiple V-belt drive — antifriction bearings throughout—and adjustable guide rollers with tapered face.

Three of the new Smith models, each having a capacity of 4 yards per batch, were recently purchased for the T. V. A. Cherokee Dam Project.

Multifoote 34-E Paver.

Single Drum Paver

Foote Company, Inc., Nunda, N. Y.

Today's paving contracts demand speed and big output, and the Multi-Foote single drum 34-E paver is said to profitably fill this need regardless of the size of the job. The paver has a 34 cu. ft. capacity plus 10% on a 6% grade in accordance with A. G. C. Standards—a total capacity of 37.4 cu. ft. The MultiFoote 34-E has been in service during the past year on a wide range of jobs, including boulevards as well as highway work. The illustration shows the White Consolidated Inc. machine operating on Sacramento Blvd. in Chicago. This machine averaged close to 400 batches per eight-hour day. The I. D. Lain Construction Company machine on a State highway out of Chillicothe, Illinois, last summer averaged approximately 1,000 feet of 20-ft. slab per day.

The new MultiFoote 34-E is compactly built and it is claimed that it is as easy to maneuver and transport as the smaller 27-E machines. For transportation by trailer, the superstructure may be lowered by power after pulling out two pins. The machine is so designed that no water connections or other parts need be disassembled. One contractor has reported that he can make the machine ready for travel by trailer in approximately ten minutes.

Construction features include a double-cone drum, fully-enclosed travel gears running in oil, Timken bearings on all high-speed shafts, a power takeoff consisting of helical cut gears running in oil, a water system which is unaffected by line pressure or a change in grade. All mechanisms are easy to get at.

Complete information on the Multi-Foote single drum 34-E paver is available from the Foote Company, Nunda, New York.

Model LP Carryall Replaces Old P

To give increased efficiency for stripping, road construction and similar earthmoving with scrapers of average size, R. G. LeTourneau, Inc., has developed a new single bucket, cable controlled carryall scraper, the Model LP, replacing the Model P, for use behind D8 "Caterpillar" tractors. Struck capacity is 12.1 cubic yards, and heaped 15.

New LeTourneau features on the Model LP include apron cable deadended for longer cable life; new apron design for increasing capacity, reducing overflow and facilitating loading by reducing friction; and a new overhead traveling sheave assembly which keeps dirt out of the sheaves and lengthens cable life. Also it incorporates positive ejection and regulated spread, controlled cutting, narrow 8′ 6″ cutting edge, tailgate cable pull at load center, and box beam arc welded construction for great strength and light weight.

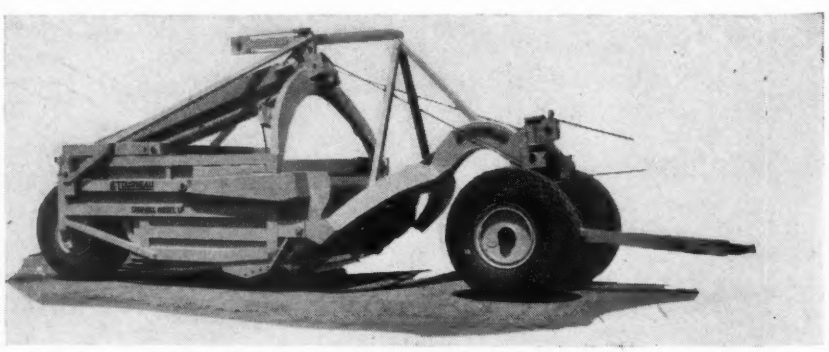
Designed for use behind a standard D8 tractor, this unit combines easy loading with large capacity. Its ability to load easily and efficiently without the aid of a pusher makes it an economical unit for use either singly or in fleets.

New Luminaire for Intersection Lighting

General Electric Co., Schenectady, N.Y.

A new incandescent luminaire, particularly adapted for the lighting of street and highway intersections, has been added to the Form 79 line, it has been announced by the General Electric Company. It is designed for operation on multiple or series circuits up to 5000 volts, and is adaptable for bracket, mast arm, or span wire mounting.

Principal feature of the new light is the use of a rippled bowl refractor which is used to direct the light up and down the intersecting roads. This serves to provide more night protection through greater visibility and warning to drivers approaching the intersection. The refractor is of the four-way distribution type which can be converted for three-way distribution where necessary by the addition at the factory of a deflector to the luminaire.



Model L P LeTourneau carryall scraper.

PEOPLE . . . *Here and There*

Louis R. Howson

New Officers for American Water Works Association

The Nominating Committee reported to the Board of Directors meeting held on January 13th, 1941, that the group recommended the election of the following officers for the year 1941-1942. Louis R. Howson for President, Abel Wolman for Vice-President, Wm. W. Brush for Treasurer.

The period, as provided in the Constitution, for additional nominations to be made by members of the Association has passed and Messrs. Howson, Wolman and Brush are respectively President-elect; Vice - President - elect and Treasurer-elect of the American Water Works Association. Their terms begin at the close of the 1941 convention and end with the close of the 1942 annual convention.

Norton Company Elects George N. Jeppson President

Mr. Jeppson has been with the Norton Company for 49 years and has been Vice President and Treasurer for some years past. He succeeds Mr. Aldus T. Higgins who resigned to become Chairman of the Board.

Federal Government Again Recruits Engineering Draftsmen

Engineering draftsmen in various optional fields are urgently needed by the United States Government. A civil service examination held last fall failed to produce enough eligibles to meet the demand of the national defense program. The United States Civil Service Commission has, therefore, reannounced the examination and will accept applications until December 31, 1941. The salaries of the positions range from $1,620 to $2,600 a year less a 3½ percent retirement deduction. High-school education except for substituted drafting experience is required. Applicants must also show paid drafting-room experience, or completion of a drafting course in a school specializing in drafting, or college engineering or architectural study; in addition they must show drafting experience in the optional branch chosen. Completion of study in engineering or architecture in a school above high-school grade may be substituted for a part of the drafting training or experience.

Competitors will not be required to take a written test, but will be rated on their education and experience as shown in their applications, and on corroborative evidence.

Further information and application forms may be obtained from the Secretary of the Board of U. S. Civil Service Examiners at any first- or second-class post office, or from the U. S. Civil Service Commission, Washington, D. C.

Chain Belt Chooses J. C. Merwin President

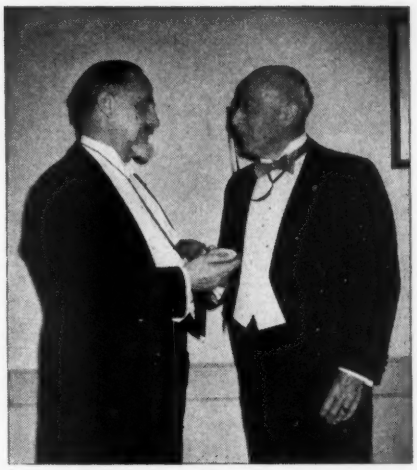
At the annual meeting of the Board of Directors of Chain Belt Company, J. C. Merwin, Vice-President and Treasurer, was elected President of the Company to succeed C. R. Messinger who died February 4th.

Herbert Spencer Elected Asphalt Institute Head

At their Annual Meeting the Board of Directors of The Asphalt Institute elected as their first full-time President, Herbert Spencer of the Standard Oil Company of New Jersey, for the fiscal year beginning April 1, 1941.

Vice Presidents elected were J. A. Blood of Standard Oil Co. of California, J. F. Lucey of Talco Asphalt & Refining Co., and H. B. Pullar of Berry Asphalt Co. A. M. Maxwell of Standard Oil Co. of Ohio was elected Chairman of the Executive Committee with Messrs. Blood, Lucey, Spencer and Waxman as members; David Waxman of Shell Oil Co., Inc., Treasurer and George R. Christie, Socony-Vacuum Oil Co., Inc., Secretary.

W. R. Macatee who had been serving as Assistant and also Acting Managing Director was elected Managing Director with office at 801 Second Avenue, New York, N. Y., continuing also in direct charge of the Washington, D. C., office of the Institute.



Dr. Dorr, left, receiving medal from Dr. M. T. Bogert.

John Dorr Receives Perkin Medal for 1941

Awarded by Society of the Chemical Industry for Application of Chemistry to Industry

The Perkin Medal, highest award in the chemical profession, was awarded to Dr. John Van Nostrand Dorr, president of The Dorr Company, Inc., New York, by the unanimous vote of a committee representing the five chemistry and chemical engineering societies, at the Chemists' Club, New York, Friday evening, January 10. This award, established in 1906 in honor of the late Sir William H. Perkin, is awarded annually for outstanding achievement in the application of chemistry to industry.

The speakers, in addition to Dr. Dorr, were Dr. Milton C. Whitaker, Director and Vice President of the American Cyanamid Company, who spoke on the Medallist's technical achievements, and Goldthwaite H. Dorr, a brother, who discussed the Medallist as a man. Dr. Marston T. Bogert, senior past president of the Society of the Chemical Industry, presented the medal on behalf of the American Chemical Society, the American Institute of Chemical Engineers, the American Electro-Chemical Society, the Society of the Chemical Industry, and the Societe de Chemie Industrielle.

Ludlow Announces Executive Changes

Alfred W. Thompson was elected President, Treasurer and General Manager of The Ludlow Valve Manufacturing Co., Inc. of Troy, New York, at a recent meeting of the Directors held in New York City. Mr. Thompson was formerly Vice President and General Manager.

He succeeds as President, Livingston W. Houston, who has been associated with the Company for twenty-two years and as President for the past eight years. Mr. Houston was elected Chairman of the Board and will continue in

an active executive capacity in the management of the Company.

Joseph H. Egolf, associated with the Company for the past fifty years and Treasurer for the past eight years, retired from active service on December 31, 1940.

Other new officers elected were Harry Hoffman of 30 Pine Street, New York City, a Vice President, and John Ireland of Troy, an Assistant Secretary and Assistant Treasurer.

Robert Bischoff, formerly associated with the Koppers Company in a sales and engineering capacity, has been appointed Sales Manager. He succeeds Joseph H. Egolf.

Johns-Manville Men Called To Active Duty With Navy

J. H. P. Hughart, J.-M. Transite Pipe Manager for the Chicago area, has resigned to rejoin the U. S. Navy as Lieutenant Commander for the duration of the present emergency. Mr. Hughart will be stationed at Northwestern University in Chicago, in the Department of Education. V. C. Wyle, junior salesman in Northern Indiana for Johns-Manville, has also accepted active duty in the Navy with the rank of Ensign.

To fill the position left by Mr. Hughart, Johns-Manville has selected L. P. Lessard, who from many years experience is familiar with the problems of water works in the Chicago district. In addition to this change new positions have been created to handle the increasing sales of Johns-Manville Transite Pipe in the territory.

Filling these positions are: D. A. Decker, formerly chief engineer of the Concrete Pipe Association, to handle the sale of Transite Pipe in Northern Illinois; Gilbert Smith, formerly associated with Consoer, Townsend and Quinlan, Chicago consulting engineers, who will be in charge of Transite Pipe sales in Northern Indiana; and Verne Coulson, formerly pipe installation instructor for the Chicago district, who will take charge of Transite Pipe sales for Eastern Wisconsin.

Other Appointments

George Goodman will represent Simplex Valve & Meter Co. in Maryland, District of Columbia, and northern Virginia with headquarters at 3903 Park Heights Ave., Baltimore, Md.

Karcher-Wolter-Foley Company, 300 Wichita St., Wichita, Kas., Southern Equipment and Tractor Co., Monroe, La., and J. S. Main, Seekonk, Mass., have been appointed distributors for General Excavator Co. and Osgood Co.

Johns-Manville has opened a new southern office in Atlanta, Ga., headed by Thomas J. Roberts.

New distributors for The Hercules Co.'s "Ironeroller" include: Scranton Tractor & Equip. Co., 1232 Penn Ave., Scranton, Pa., Tractor & Equipment Co., Sidney, Mont., Karcher-Wolter-Foley Co., 300 Wichita St., Wichita, Kas.

NEW OFFICIALS

Among the new City Engineers reported are:

R. G. Baker, Phoenix, Ariz.
R. A. Boyce, Little Rock, Ark.
J. E. Ganett, Paragould, Ark.
H. Lester Janney, Muncie, Ind.
Noble Spiker, Vincennes, Ind.
Fred D. Farnsworth, Bangor, Me.
J. C. Utton, St. Louis Park, Minn.
J. S. Manion, Kearney, Nebr.
Lloyd W. Cowan, Shawnee, Okla.
Don DeWitt Williams, Corry, Pa.
A. M. Stevenson, West Newton, Pa.
Chas. A. Trimmer, Mitchell, S. D.
G. Gould Smith, Lebanon, Tenn.
C. A. Bartholow, Bryan, Tex.
James S. Hughes, Fredericksburg, Va.

The following City Managers have been appointed:

G. B. Wilkes, Cordele, Ga.
Irving C. Trufant, Dover-Foxcroft, Me.
L. M. Davis, Borger, Tex.

New County Engineers include:

Milton L. Johnson, Doniphan County, Troy, Kan.
Hal. Parker, Henry County, Clinton, Mo.
Chas. E. Wright, Prairie County, Terry, Mont.
Lyman Raef, Socorro County, Socorro, New Mexico.

Water Works Superintendents recently appointed are:

J. C. Mooman, Sterling, Ill.
Frank F. Williams, Grandfield, Okla.
R. W. Cowart, Bryan, Tex.
E. L. Reid, Cleburne, Tex.

Maryland Engineers Hold Election

The Maryland Association of Engineers held their 12th Annual Meeting at the Southern Hotel in Baltimore, Maryland, on January 23-24, 1941.

The following officers of the Association for 1941 were announced at the Banquet on Thursday evening:

President—W. H. Cullimore, Chief Engineer and Secretary, National Paving Brick Association.

1st Vice-President—Leroy Kern—Right-of-way Engineer, Maryland State Roads Commission.

2nd Vice-President—Luke Ellis, Chief, Mechanical-Electrical Bureau, Baltimore City.

Secretary—R. Donald Wooten, Maryland State Roads Commission.

Treasurer — H. M. Parker, Portland Cement Association.

Field Secretary—R. R. Glen, Arundel Corp., Baltimore.

Board of Directors—T. Edgie Russell, Contractor, Frederick, Md.; G. A. Carter, Highways Engineer, Baltimore City; Ralph L. Rizer, City Engineer, Cumberland, Md.; John A. Bromley, County Engineer, Anne Arundel County.

Annual Meeting

Maryland-Delaware Water and Sewerage Association will hold its Fifteenth annual conference at Hotel Raleigh, Washington, D. C., May 8th and 9th—C. F. Garland, Baltimore, Md., is Secretary-Treasurer.

NEW CATALOGS

Rotary Distributors

Of interest to civil engineers and sewage treatment plant officials is a new 24-page bulletin, No. 213, showing representative views of the many P. F. T. Rotary Distributor installations and giving complete details concerning their design, construction and operation.

Details of the P. F. T. Patented Spreader Jet are given and P. F. T. Double Flow Rotary Distributors are also covered. Copies are available upon request to the Pacific Flush-Tank Company, 4241 Ravenswood Avenue, Chicago, Ill.

New Features of the Automatic Magnetite Filter

The application of the Automatic Magnetite Filter to four different types of sewage treatment plants, illustrated in . . flowsheets covering plain sedimentation, chemical precipitation, trickling filter treatment and activated sludge process are explained in a folder which also contains sketches of the various ways in which this filter may be installed, either in separate structure or in combination with mechanical flocculator, mechanical clarifier, or combination of flocculator and clarifier.

Gives operating data—operating performance figures from six different installations; a list of 44 Automatic Magnetite Filters now installed in 23 plants with a design capacity of 2300 m.g.d. Copies of the folder can be had by writing to Filtration Equipment Corporation, 10 East 40 St., New York, N. Y.

L & N Photometers: Photometers and illuminometers for lamp testing, lighting surveys, photometric research and educational use, a 20-page catalog just issued by Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia, Pa. Ask for Catalog E-72.

Waterproofing: Technical literature issued by Koppers Co., Tar & Chemical Division, Pittsburgh, Pa., describes waterproofing and dampproofing.

Essolube Hd: Complete description of the properties of the first widely adaptable, high stability, high viscosity index detergent type of oil for heavy duty gasoline and diesel engines will be found in 16 page booklet issued by Standard Oil Company of New Jersey, Publications Department, Room 1569, 26 Broadway, New York City.

Vulcalock Valves: The B. F. Goodrich Company, Akron, Ohio, has just issued a new catalog sheet on its patented Vulcalock valve for handling corrosive and abrasive fluids under conditions of fairly high pressure, pulsating pressure, throttling or suction.

Uses of Creosote: The physical and chemical properties of Koppers Creosote and Koppers Creosote-Coal Tar Solutions are subjects of technical folders just published by Koppers Company, Tar and Chemical Division, Pittsburgh.

Readers' Service Department

These booklets are FREE. Use the coupon below or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Asphaltic Limestone

5. Characteristics, methods of laying, and results with cold lay mixture shipped ready to use. Especially adapted to resurfacing old pavements, sealcoats and airport runways. Alabama Asphaltic Limestone Co., Liberty Nat. Life Bldg., Birmingham, Ala.

Cold Mix Plants

10. New catalog and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subject suggested by title.

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

33. Pocket manual of concrete curing with calcium chloride. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, N. Y. C.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Concreting in Winter

47. "Build Straight Through the Cold Weather Season" explains briefly how to obtain satisfactory winter concrete in less time. Write Michigan Alkali Co., 60 East 42nd St., New York, N. Y.

Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Drainage Products Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

71. Modern Culvert Practice — a 72 page book containing valuable data and tables will be sent promptly to anyone interested in drainage by Gohi Culvert Mfrs., Inc., Newport, Ky.

Generators

75. Homelite portable gasoline engine driven generators, both direct current and alternating current type, in sizes ranging from 500 watts output to 3,000 watts output, are fully described and illustrated in new folder. Homelite Corp., 2400 Riverdale Ave., Port Chester, N. Y.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

Paving Materials, Bituminous

111. An excellent booklet issued by The Barrett Co., 40 Rector St., New York, N. Y., describes and illustrates the uses of each grade of Tarvia and Tarvialithic; 32 good illustrations.

Paving Materials, Brick

116. "New Developments in Brick Pavements." A review of the developments in brick pavements in recent years. Issued by the National Paving Brick Association, National Press Building, Washingon, D. C.

Pumps

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

122. CMC pump bulletin illustrates and describes complete line of modern centrifugals made in sizes from 1½" to 10" by Construction Machinery Co., Waterloo, Iowa.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

125. Homelite portable self-priming centrifugal pump, gasoline driven, in sizes from 1½" to 4", fully described and illustrated in new folder. Homelite Corp., 2400 Riverdale Ave., Port Chester, N. Y.

Retaining Walls

126. Charts showing the design of cellular or bin-type metal retaining walls, helpful suggestions on their use for stabilizing slopes, preventing stream encroachment, and solving problems of limited right of way, and construction details are given in a 16-page bulletin entitled, "ARMCO Bin-Type Retaining Walls." It is published by the Armco Drainage Products Association, Middletown, Ohio, and member companies. Ask for Bulletin H-37.

Road Building and Maintenance

127. See road work as it was done in the 1890's and as it can be done by a full line of this year's road building equipment. See, in this new action picture book, the first reversible roller, 1893 World's Fair Award Grader and how methods have changed. Attractive new booklet AD-1796 recently issued by The Austin-Western Road Machinery Co., Aurora, Ill.

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalogs Nos. 253, 254 & 255, issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

129. New bulletins illustrate and describe the latest line of Littleford Utility Spray Tanks, Street Marking Units, Street Flushers and Kettles. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

130. Toro patching rollers, tractors and mowers for parks, airports, estates, highways and golf courses are pictured and detailed in new illustrated booklet available from Toro Mfg. Co., Minneapolis, Minn.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. Hercules Co., Marion, Ohio.

Spreader

147. Jaeger Paving equipment, including Mix-in-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.— 4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principals and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated. 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York, N. Y.

152. The Columbia Alkali Corporation, will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York City.

153. "Rock Salt for Stabilized Roads" is a handy, illustrated booklet telling how to construct and maintain salt-soil-stabilized roads. Sent on request by International Salt Co., Scranton, Pa.

154. "Soil Stabilization with Tarvia" —An illustrated booklet describing The steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Company, 40 Rector St., New York, N. Y.

Steel Forms

156. Complimentary Bulletin A-20-F, issued by The Heltzel Steel Form and Iron Co., Warren, Ohio, contains complete information on the use of steel forms for constructing concrete curbs, curb and gutters and sidewalks.

Tire Data

158. Handy pocket-size Goodyear Truck Tire Data Book contains load and inflation tables, dimenson data, factors governing mileage, for all types and sizes of truck, earthmoving and road grader tires. Also tables of weights and measures.

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(Continued from page 63)

Write Truck and Tractor Tire Div., Goodyear Tire & Rubber Co., Akron, O.

Tractors

159. "International Diesel TracTracTors" is a 48-page catalog giving full details of TracTracTors, including action pictures with bulldozers, bullgraders, blade graders, wheel scrapers, elevating graders, etc. Sent promptly by International Harvester Co., 180 North Michigan Ave., Chicago, Ill.

Street and Paving Maintenance

Asphalt Heaters

198. Illustrated Bulletins 15 to 20 describe Mohawk Oil Burning Torches; "Hotstuf" Tar and Asphalt Heaters; Portable Trailer Tool Boxes; Pouring Pots and other equipment for street and highway maintenance, roofing, pipe coating, water proofing, etc. Mohawk Asphalt Heater Co., Frankfort, N. Y.

199. Aeroil "Heet-Masters" for quick heating and melting of tar, pitch, asphalt, etc., with less fuel are illustrated and explained in new catalog No. 196W issued by Aeroil Burner Co., Inc. Box 599, West New York, N. J.

Dust Control

210. "How to Maintain Roads with Dowflake" is a new 58 page illustrated booklet of information on stabilized road construction. Includes specifications and several pages of reference tables from an engineer's notebook. Issued by Dow Chemical Co., Midland, Mich.

211. A complete booklet on dust control titled. "Dust Control and Road Stabilization," describes the use of Columbia Calcium Chloride for dust control purposes and stabilization of roads. Sent on request by Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York, N. Y.

212. "Are you Annoyed by Dust?" an illustrated circular telling how to prevent dust with calcium chloride. Sent free by Michigan Alkali Co., 60 East 42 St., New York, N. Y.

Radio Communication, Two Way

250. Valuable information on how cities and towns all over the country have solved their radio communication problems is found in "Motorola Radio Communication Equipment." Write Galvin Mfg. Corp., 4545 West Augusta St., Chicago, Ill.

Sprayers

280. Cutback sprayers with new "single unit safety control" and full control of all spraying operations from the nozzle are described and illustrated in new bulletin No. 190 W issued by Aeroil Burner Co., Box 599, West New York, N. J.

Street Markers

300. Street marking simplified by the use of modern, self-contained units capable of handling any kind of striping jobs is the subject of an illustrated bulletin giving also full details of new M-B Street Markers. Sent by Meili-Blumberg Corp., Box PW, New Holstein, Wis.

Snow Fighting

Plows

349. "V-type Plows for Motor Trucks" is a handsome new 24 page catalog illustrating the wide variety of models and many special features of Frink Sno-Plows and leveling wings. Tells how to select the proper plow for your trucks. Write Carl H. Frink, Mfr., Clayton, N. Y.

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Co., 60 East 42 St., New York, N. Y., tells how to use calcium chloride for modern ice control.

352. "Rock Salt's 'Auger Action' makes it most effective for removing ice from roads and streets" is a new illustrated folder just issued by International Salt Co., Scranton, Pa.

Sanitary Engineering

Aero-Filter

356. New illustrated bulletin gives complete information on design of Aero-Filters to provide high-capacity, uniform, raindrop application over the entire filter bed. Write Lakeside Engineering Corp., 222 West Adams St., Chicago, Ill.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

Activation and Aeration

376. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

Cleaning Sewers

383. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

Diesel Engines

386. Write Dept. 118, Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago, Ill., for data on how the installation of F-M diesels has lowered taxes and made it possible for many communities to pay for their improvements out of municipal power plant earnings.

Feeders, Chlorine, Amonia and Chemical

387. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. % 96 Codding St., Providence, R. I.

Filter Bed Agitator

388. 60-page booklet, "The Mechanics of Filter Bed Agitation," containing engineering data, technical information concerning surface wash and opinions of users will be sent promptly by Activated Alum Corp., Curtis Bay, Baltimore, Md.

Filter Plant Controllers

389. "The Modern Filter Plant" and the uses of Simplex Controllers for operation are described in a handy, 16-page booklet. Charts, data, curves and tables. Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Fire Hydrants

390. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Anniston, Ala.

391. See listing No. 410.

Flow Meters

393. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others — and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750

Gates, Valves, Hydrants

394. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

395. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

396. See listing No. 410.

Hypochlorinators

400. New illustrated booklet W&T 357 describes this simple, inexpensive means of protecting small water supplies such as summer camps, hotels, swimming pools, dairies, etc., as well as for feeding chemical solutions in the water works plant. Contains typical installation sketches. Write "Wallace & Tiernan Co., Inc., Newark, N. J.

Manhole Covers and Inlets

402. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave., South Bend, Ind.

Manhole Cover Silencers

403. New bulletin on Tapax for quickly ending noisy manhole covers and small sample free. Write Tapax Mfg. Co., 201 Hoyt Ave., Mamaroneck, N. Y.

Meters, Venturi

405. MS Meters for use with venturi tubes, flow nozzles, etc., in wall, panel, or floor mounting are covered in detail in catalog sent free by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

406. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corroson, clogged pipes, etc. Write Builders Iron Foundry, Codding St., Providence, R. I.

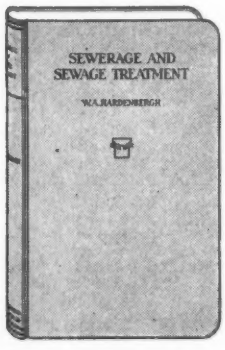
Meters, Water

407. Complimentary bulletin W529 tells all about Pittsburgh IMO water meters, "the meters that wear in where others wear out." Write Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Pipe, Cast Iron

408. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York, N. Y.

409. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.



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410. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia, Pa.

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Pipe, Reinforced Concrete

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Pipe, Transite

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Pipe Joints, Sewer

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437. "Metal Sheeting for Lower Average Job Costs" is a new bulletin about light weight sheeting you can use again and again. Issued by Armco Drainage Products Assn., Middletown, Ohio.

Septic Tanks, Small

438. Septic Disposal Systems, Waterless Toilets, Multiple Toilets for Camps and Resorts, and other products for providing safer sewage disposal for unsewered areas are described and illustrated in data sheets issued by San-Equip Inc., 504 E. Glen St., Syracuse, N. Y.

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440. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 216-P East 45th St., New York, N. Y.

441. Full information about Nichols modern, efficient gabage and refuse incinerators now available in the Basket Grate, Continuous Grate, Revolving Grate and Monohearth types will be sent promptly by Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

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443. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes — a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

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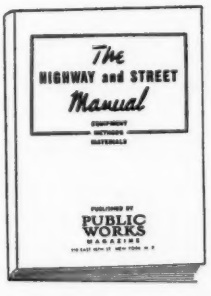

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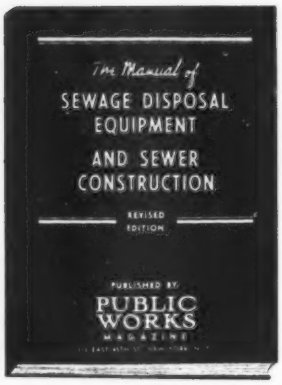

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This is the title of a bulletin issued by Activated Alum Corporation, Curtis Bay, Baltimore, Md. It explains the difference between Standard Activated Alum and Black Alum and gives the physical properties of both.

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